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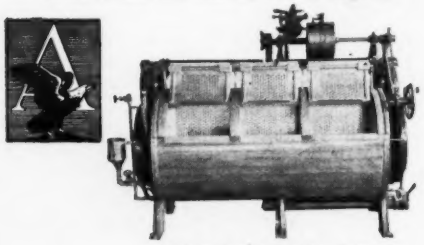

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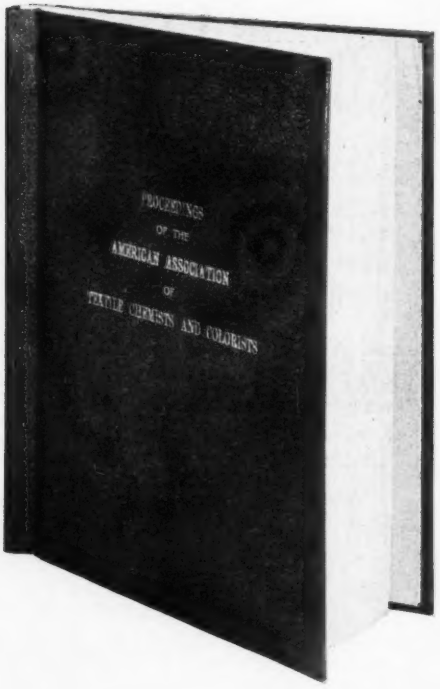

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VOLUME XIII NEW YORK, MARCH 24, 1924 NUMBER 5

The Bleaching of Paper-Making Fibers

Part I

Differences in Bleaching Paper and Textile Fibers—Bleaching Agents—Their Preparation—Chlorine—Potassium Permanganate—Apparatus Used in Paper Bleaching—Factors Influencing Bleaching—Concentration—Temperature

By E. SUTERMEISTER

THERE are certain essential differences between the bleaching of fibers for paper making and those for textile work, and the reasons for these differences must be borne in mind in order to have a thorough understanding of the subject. Textile fibers, before bleaching, are usually more impure than those used in paper making, and the impurities are more varied in their character. This necessitates a much more complicated bleaching process which includes boiling with alkali, bleaching with calcium hypochlorite solution and treatment with acid, together with numerous intermediate washings. These processes are necessary to remove the pectic substances, intracellular materials, and fatty or waxy constituents of the fibers, as well as the coloring matters with which they are associated. In the case of paper-making fibers the treatment with alkali is conducted as a separate and distinct operation previous to bleaching, while the use of acid is seldom found necessary. In the sulphite process the treatment with calcium bisulphite solution performs a function similar to that of soda in the alkaline processes and leaves the fibers comparatively free from impurities and in a condition to be acted on readily by the bleach.

The physical characteristics of the two classes of fibers when subjected to the bleaching operation also have a very large influence on the methods and apparatus employed. Cotton is sometimes bleached loose, or in the form of cops, hanks or warps, but by far the greater part of it is treated after it is spun and woven into cloth. Linen is also nearly always bleached in the piece. Paper stock, on the other hand, is desired in the form of ultimate fibers, and the bleaching operation takes place after this state has been reached and while the fibers are mixed with water in the proportion of 1 part of fiber to 5 to 40 parts of water, according to the type of apparatus used. Closely connected with this difference is the fact that in textile work considerable quantities of sizing containing starch, soap, tallow, zinc chloride or other materials are used in preparing the warps, and this must be removed if perfect bleaching is to result. No such additions are made to paper fibers, except in the case of rags, and the bleaching operation is consequently much simpler.

Bleaching Agents

The chief bleaching agent used in preparing paper stock is calcium hypochlorite, but among other materials which have been used or proposed are sodium hypochlorite, chlorine gas, potassium permanganate, sodium peroxide and hydrogen peroxide. For reasons of convenience, cost or efficiency these other substances are seldom used, and probably not 1 per cent of the total bleached fiber is prepared by their means.

Calcium hypochlorite may be prepared for use either by dissolving bleaching powder or by absorbing chlorine gas in milk of lime. In either case the solution is filtered or allowed to settle, and the clear liquor only is used. Bleaching powder is known to deteriorate more or less rapidly during storage, depending on the type of containers and especially on the temperature—the higher the temperature, the more rapid the deterioration. For this reason bleaching powder should be stored for as short a time as possible, and should be carefully tested upon receipt to see that it is up to the proper standard for strength. Solutions made from it should be tested for strength by chemical analysis, rather than by means of hydrometers, for the decomposition products of bleach are mostly soluble and will affect the hydrometer in the same way as bleach solution, while at the same time being valueless for bleaching purposes. Bleach solutions are subject to the same decompositions as powders, and if they have to be

stored for any length of time should be kept in tall narrow tanks where they will be exposed to light as little as possible. In preparing solutions from bleaching powder long agitation is to be avoided, as it causes slow settling and a large volume of sludge. The temperature also has an influence on the volume of sludge, the quantity decreasing with increase in temperature. The most satisfactory conditions for preparing solutions are probably about twenty minutes' agitation at 75 to 80 deg. Fahr.

Bleach solutions are frequently prepared by passing chlorine gas into milk of lime. The chlorine gas may be derived from the electrolysis of brine in any of the numerous types of electrolytic cells, or it may be purchased in the liquid state and converted to a gas by passing it through a vaporizing chamber. Equally good results seem to be obtained in either way and it is probably a question of the cost of chlorine from the two sources which is the deciding factor. Where electric power is cheap and freight rates are high, it may be that the cost of chlorine produced by electrolysis would be less than that of liquid chlorine, while in other locations the reverse might be true. The successful operation of such absorption systems depends on keeping the temperature low and avoiding an excess of chlorine, even locally. If either of these two conditions is not observed chlorine is lost by being converted to chlorate, but if satisfactory conditions are maintained it is possible to produce solutions containing as high as 250 grams per liter of 35 per cent bleach with 96 per cent of the chlorine in the available state. Such solutions are, of course, too strong to use in actual bleaching operations, but they are economical of storage space and may readily be diluted to the desired strength when wanted. This strength may vary according to the conditions in different plants, from as low as 30 grams per liter to as high as 100 grams per liter of 35 per cent bleach (10.5 to 35 grams per liter available chlorine).

At one time great claims were made for a bleach solution prepared by electrolyzing a salt solution and allowing the chlorine to combine with the alkali formed. It was proposed to pass this solution through the fiber to be bleached and then back through the electrolyzer in a closed circuit, but it was found that the impurities from the fiber soon accumulated to such an extent as to interfere with the proper operation of the process. Later work has proved conclusively that such an electrolyzed salt solution possesses no advantages over ordinary hypochlorite solutions and the process is no longer given consideration by paper makers.

Chlorine gas is sometimes used as a bleaching agent, the material to be bleached being treated in a moist condition in closed receptacles. This treatment as applied to rags, rope stock, etc., is very efficient in removing shives and metallic particles. When applied to sulphite fiber, chlorine, either in the form of gas or dissolved in water, has not proved a satisfactory bleaching agent when used alone. If the treatment with chlorine is followed by washing with water or caustic soda solution and the pulp is then bleached with hypochlorite, much better results are obtained. This method is said to save about half the total amount of chlorine used when hypochlorite alone is employed. A "super-bleaching" process has recently been patented in which the pulp is first bleached with hypochlorite as usual, washed and treated with an antichlor to remove traces of bleach if necessary. It is then treated with chlorine water and finally with bisulphite to neutralize hydrochloric acid and combine with any remaining chlorine. It is then washed thoroughly with clear water. This process is claimed to give a much whiter product than the regular hypochlorite bleach with much less injury to the fiber. In spite of its good bleaching efficiency, chlorine is seldom used as a direct bleaching agent, probably because of the difficulty of maintaining tight equipment and the general inconvenience of handling a gaseous material.

Potassium permanganate has been proposed as a bleaching agent for paper stock, and while it has probably been used to a greater or lesser extent its high price makes it uneconomical. It has the advantage of being very rapid in its action, and many claims have been made as to its superior efficiency. Beadle found that with rag stock 1 pound of permanganate was equivalent to 10 pounds of bleaching powder, from which he concluded that the oxygen from the two substances acted quite differently. The writer's experiments with both sulphite and soda fibers have shown that 1 pound of permanganate was equivalent in 1.854 pounds of 35 per cent bleach, while according to the oxygen evolved it should equal 1.93 pounds. For wood fibers, therefore, the two substances are practically equivalent when considered on the basis of oxygen evolved. Because of the cost of bleaching with permanganate, which is still further increased by the necessity for removing the manganese peroxide by an acid treatment, the process is seldom employed in commercial work.

Other bleaching agents which have been proposed are peroxides, persulphate, perborates, etc., but so far as we are aware they are never used in this country. In fact, it has been shown that sodium peroxide is of little value for bleaching rag stock, at least, for only a partial bleaching takes place even when it is used in excessive amounts. Moreover, it is likely to attack the fiber with formation of oxycellulose.

Apparatus Used

The apparatus used in bleaching wood pulp varies widely in different plants and there is still considerable difference of opinion as to which is best. In fact, it is not possible to say that any one type would be best in all plants or under all conditions.

Probably one of the earliest methods of bleaching was to break up the pulp in a Hollander, add the bleach solution to it and let it circulate until the bleach was exhausted, or until the desired color was reached. The bleach residues and impurities were then washed out with a drum washer. This method was a direct copying of the method used in bleaching rag stock. Since it was customary to use an excess of bleach and throw away the washings, this method was wasteful.

An advance was made by using the Hollander merely as a breaking engine and to mix in the bleach, after which the charge was dumped into a drainer constructed with a false bottom through which the liquor could drain to a well. If it contained sufficient bleach it was often pumped from the well back to the Hollander when breaking up another charge. The washing of the bleached stock was accomplished by flooding the drainer with water and allowing this to drain through the stock. Since the bleached fiber had to be dug out of the drainer by hand and carried to the beating engines in trucks, this system involved the employment of much labor. This difficulty was in part overcome by increasing the size of the drainers and so arranging them that the stock could finally be sluiced out by a steam of water and run to a tank which supplied the beaters directly, or from which it passed to a wet machine to be run off into laps.

The next step was to make the process continuous by building a series of large tanks, 10 to 12 feet in diameter by 20 to 30 feet deep, connected by pipes or openings at top and bottom alternately. Each tank was equipped with an agitator and the stock which was added to the first tank gradually worked its way through until discharged at the other end of the system in the bleached condition. This system provides for no washing of the fiber, and if this is considered necessary it must be accomplished by inserting some washing device at the end of the process. As usually constructed, such systems will not handle stock much over 3½ to 4 per cent density, which makes the steam consumption high in case the stock has to be heated.

This criticism has been met in the Heiskanen system by constructing the tanks in such a way that the discharge of each is from the bottom to the top of the next tank, lining the tanks with glazed tiles and substituting screw conveyors for the usual agitators. This system is said to handle stock at 6 to 8 per cent density, and is very economical of steam as a consequence.

Similar improvements have been made in the batch methods of bleaching by increasing the size of the containers, lining them with tiles and substituting propellers for the paddles or rolls used in the Hollanders. The Bellmer system, which is probably the best known of these improved batch systems, uses a concrete tub lined with glazed tiles and furnished at one end with either a single or double acting propeller, according to the size of the units. These bleachers are constructed in large sizes, singly or in batteries, and will handle stock of 5½ to 6½ per cent density. They have been found to be very satisfactory, and are widely used.

The latest innovation in batch-bleaching systems consists of equipment which will handle stock of 12 to 18 per cent density or even higher. There are at least two such bleachers in use, and both employ helical conveyors for circulating the stock and mixing it with the bleach solution. Such systems require little steam and the bleaching is accomplished very rapidly because of the great concentration. They are said to be unusually effective in bleaching out shives and organic dirt, so that less care has to be used in preparing and cooking the wood. These bleachers are of comparatively recent introduction, and it remains to be seen how far they will replace the older types of equipment.

Factors Influencing Bleaching

The principal factors influencing bleaching, apart from the nature of the fibers themselves, are the concentration of the stock, the temperature maintained and the quality of the water used.

There is an old saying, "More water, more bleach," and if the bleaching operation is conducted by adding an excess of bleach and removing the unused portion at the end of a given time this is doubtless true. Under these conditions the greater concentration would produce a whiter fiber, since the bleaching action would go more rapidly in the stronger solutions. If, however, a definite amount of bleach is added and the action allowed to continue until the bleach is all exhausted, then the proportion of water to fiber is practically without influence on the color of the fiber, though it has a very great influence on the time required to complete the bleaching. This holds true with operations conducted at moderate concentration, such as can be reached by Bellmers, but the makers of the high concentration bleachers claim that working at densities above 12 per cent causes a very considerable saving of bleach for the same color produced. This may be true for sulphite, but the writer's tests on soda fiber show that increasing the density from 2 per cent to 24 per cent caused a slight lowering of the color. This was not a very serious change and could have been corrected easily by the addition of a little more bleach.

The concentration during bleaching has a very great influence on the time required to exhaust the bleach, as is shown in the following table, which gives the results of tests on soda fiber of moderately easy bleaching quality. Included in the table are the records for the number of shives per 100 grams of bleached fiber. Both samples were intentionally contaminated with a very large number of small shives before bleaching in order to show the influence of concentration on the removal of such impurities.

Concentration	Hours to Exhaust Bleach		Shives per 100 Gm. Bleached Fiber	
	Sample 1	Sample 2	Sample 1	Sample 2
2 per cent.....	21.8	21.8	220	1,094
4 per cent.....	13.8	12.6	158	638
8 per cent.....	6.8	6.5	71	394
12 per cent.....	4.6	4.3	59	186
18 per cent.....	1.6	0.9	..	..
24 per cent.....	1.2	0.7	..	..

As may be readily seen from this table, the higher concentrations are decidedly beneficial in reducing the number of shives as well as in shortening the time of bleaching.

Temperature

As is usual in chemical reactions, raising the temperature increases the rate at which the action takes place or, in other words, shortens the time required. This is well illustrated in the following table, which gives the bleach necessary to produce the standard degree of whiteness and also the hours required to exhaust the bleach at three temperatures:

Fiber	Bleach Used (per cent)	Hours to Exhaust Bleach at 65° C.	40° C.	20° C.
Sulphite	13.0	1.50	12.0	192.0
E. B. sulphite.....	5.0	1.25	10.8	..
Soda poplar	11.5	1.33	13.0	..

While increased temperature shortens the time of bleaching, it also increases the amount of bleach required to produce a definite color. Cross and Bevan found that esparto bleached at 0 deg. to 4 deg. Cent. used only 80 per cent of the bleach consumed at 35 deg. to produce an equal color. Simonsen, working with sulphate pulp, found that 7 per cent of bleach at 13 deg. Cent. and 9 per cent at 35 deg. Cent. gave the same degree of whiteness. Spence, on the other hand, finds that with soda poplar, increasing the temperature from 35 deg. to 50 deg. Cent. improves the color, but beyond this point the color grows poorer. It is claimed by some that temperatures over 30 deg. Cent. cause loss of bleach by transformation into chlorate, which may account for the poorer color when high temperatures are used. Authorities differ as to the maximum temperature which it is safe to employ, their opinions varying from 20 deg. Cent. to 43 deg. Cent., or even higher. The temperature which may advantageously be used in any plant often depends upon the output which must be obtained from a given equipment, for in certain cases it may be better policy to increase the temperature rather than replace equipment which is not quite large enough for the desired product. It is certainly true, however, that if the temperature rises much above 35 deg. to 40 deg. Cent. an appreciable portion of the bleach will be wasted.

(To be concluded.)

The Photochemical Decomposition of Oxalic Acid in the Presence of Uranium Salts

Its Possible Utilization as a Method of Measuring the Intensity of Sunlight and Various Artificial Lights in Connection with the Fading of Dyes

By WALTER C. HOLMES

IN the presence of uranium salts oxalic acid is decomposed by light, the reaction serving as an effective chemical photometer.* The residual oxalic acid at the conclusion of the exposure of the solution may be determined with accuracy by means of titration with permanganate.

The influence of a variety of factors upon the reaction was investigated by the writer in collaboration with H. D. Gibbs in Manila in 1910. It was established that:

1. The reaction rate is dependent primarily upon the absolute concentration of the uranium salt and may be varied at will over an extended range by means of suitable variation in that condition.

2. The influence of the concentration of oxalic acid is relatively slight in general. A critical point is found at a concentration of approximately 0.2 per cent. Below this point the reaction rate is greatly retarded, whereas considerable increases in concentration above this point are attended by only comparatively slight retardation.

3. A slight but distinct retardation in rate occurs during exposure, increasing in degree with the increasing percentage decomposition of the oxalic acid, which may be attributed to the influence of decomposition products.

4. The reaction may be appreciably influenced by such factors as the shape, thickness and material of the containing vessels, and even by the nature of the background (if any) upon which they rest. It is advantageous to employ round-bottomed quartz flasks, supported by the neck, and a solution volume such that the solution will form a nearly spherical body, presenting equal surface under varying angles of incidence of light. In order to

(Continued on page 197)

*Bruner and Kozak; Zeit. Electrochem. **17,** 354 (1911). Frear and Gibbs; Orig. Comm. 8th Int. Congr. Appl. Chem. **20,** 160 (1912). Mathews and Dewey; Orig. Comm. 8th Int. Congr. Appl. Chem. **20,** 247 (1912). Bertholet and Gandechon; Compt. Rend. 152, 262 (1911). Bertholet and Gandechon; Compt. Rend. 157, 333 (1913). Henri and Landau; Compt. Rend. 158, 181 (1914). Bertholet; Comp. Rend. 158, 1791 (1914).

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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LOCAL SECTIONS AND THEIR OFFICERS

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A. K. Johnson, Secretary, Lowell Textile School, Lowell, Mass.

Rhode Island Section—
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New York Section—
Elvin H. Killheffer, Chairman, Newport Chemical Works, Passaic, N. J.
Herbert Grandage, Secretary, 121 Willard Avenue, Bloomfield, N. J.

Philadelphia Section—
Charles S. Hollander, Chairman, Rohm & Haas Company, Philadelphia, Pa.
Percival Theel, Secretary, Philadelphia Textile School, Philadelphia, Pa

TWENTY-FIRST COUNCIL MEETING

The twenty-first meeting of the Council was held at the Engineers Club, Boston, Mass., on Saturday afternoon, March 1, 1924.

The following members were in attendance: L. A. Olney, P. J. Wood, H. Christison, W. C. Durfee, C. S. Hollander, G. A. Moran, W. D. Livermore, W. R. Moorhouse, W. H. Cady, W. K. Robbins, W. M. Scott, E. H. Killheffer, R. F. Culver, W. E. Hadley.

The list of applicants who were admitted to Active and Junior membership at this Council meeting was published in the March 10th issue on page 79 of the Proceedings.

A letter was received from Dr. Herty of the Synthetic Organic Chemical Manufacturers Association requesting that a member be appointed to serve on the committee which will have charge of the Testimonial Dinner to Francis P. Garvan. Prof. Olney was chosen to represent the Association on this committee.

The Philadelphia Local Section extended an invitation, through their chairman, Dr. C. H. Hollander, that the Council consider the advisability of holding the next Annual Meeting in Philadelphia. The Council unanimously voted to accept the invitation and the next Annual Meeting will, therefore, be held in Philadelphia. It was considered advisable to thus early make the decision in order that the members of that section will have ample time to thoroughly acquaint the manufacturers and others in this regard.

The matter of a Questionnaire, which is shortly to be sent to the members, was fully discussed, and the wish was expressed that each member make a special effort to completely fill out such Questionnaire, upon receipt of same, and return immediately to the Secretary.

In considering the By-Laws for Local Sections, the question arose as to the advisability of allowing Junior Members to vote in sectional matters, and it was decided, by the Council, that Junior Members could vote in sectional matters but that only Active Members could be elected to Chairmanship of Local Sections.

Mr. Appel, of the Bureau of Standards, Washington, D. C., was elected a member of the Research Committee.

Regarding the list of prizes offered last year for the best papers on various subjects, it was decided to again publish a list of the prizes this year, but the designation of same will await the return of the Questionnaire.

The following applicants were admitted to membership in addition to those whose names were published in the Proceedings of March 10th:

Active Members

Delhanty, George W., Box 322, Taunton, Mass., textile dyer, Taunton Dye Works & Bleachery Company.
Fleming, Louis J., 9 Maryland Avenue, Pawtucket, R. I., vat dyer, Definance Bleachery, Barrowsville, Mass.
Genssler, Dr. O. H., 240 Water Street, New York, N. Y., technical manager, Sandoz Chemical Works, Inc.

Junior Members

Streckfuss, F. C., 131 N. Twenty-first Street, Philadelphia, Pa., student Philadelphia Textile School.

Walsh, F. C., 131 N. Twenty-first Street, Philadelphia, Pa., student, Philadelphia Textile School.

WALTER E. HADLEY, Secretary.

RESEARCH COMMITTEE MEETING

The nineteenth meeting of the Research Committee was held at the Engineers' Club, Boston, Mass., on Saturday afternoon, March 1, 1924.

The following members were in attendance: L. A. Olney, P. J. Wood, H. Christison, W. C. Durfee, C. S. Hollander, G. A. Moran, W. D. Livermore, W. R. Moorhouse, W. H. Cady, W. K. Robbins, W. M. Scott, E. H. Killheffer, R. F. Culver, Mr. Appel, W. E. Hadley and Ed. F. L. Lotte.

The Research Committee was particularly favored in having Mr. Appel and Mr. McGowan of the Bureau of Standards present at the meeting, who discussed with the Committee the different phases of the work which the Bureau was undertaking and the possible ways in which the Bureau of Standards and the American Association of Textile Chemists and Colorists could work in co-operation to the mutual advantage of all concerned. It was finally agreed that these gentlemen would prepare tentative plans and methods which could be considered at some later date, the object being to prevent duplication of the work of these two organizations and to promote the general welfare of each.

The Committee on Light Fastness, William H. Cady, Chairman, reported progress, but certain phases of the work still present some difficulties and immediate steps are being taken to investigate these conditions and a report of the work of this committee will shortly follow.

Additional explanatory notes relative to the fastness of dyed woolen material have been prepared by William D. Livermore, Chairman of this committee, which will shortly be published.

Such additional data will also shortly be furnished by Dr. W. M. Scott, Chairman of the Committee on Fastness of Silk Material.

William R. Moorhouse, Chairman of the committee investigating the fastness of dyed material to alkali, and H. Christison, Chairman of the committee investigating fastness to perspiration, both reported progress.

Mr. Appel was appointed an additional member of the sub-committee investigating the fastness of dyed material to light.

W. E. HADLEY, Secretary.

FEBRUARY MEETING OF NORTHERN NEW ENGLAND SECTION

The seventh regular meeting of the Northern New England Section was held at the Massachusetts Institute of Technology, Cambridge, Mass., on February 23, 1924.

Dinner was served to fifty members and guests, previous to which an informal gathering was enjoyed in the lounging room of the Walker Memorial.

After the dinner Prof. William J. Drisko gave a talk on "Light and Color." Professor Drisko began by explaining the various theories of color, the mechanical construction of the eye, and some of the theories of color vision.

He then demonstrated with a very complete set of apparatus the different effects and causes of color, demonstrating additive and subtractive methods of color mixing.

The most novel point touched on by Professor Drisko was the effect of light beyond the violet and of shorter wave length than the violet end of the visible spectrum.

Professor Drisko is of the belief that this has a far greater influence on the appearance of color material than has been heretofore realized, and he demonstrated very clearly that this ultra-violet, which sunlight contains appreciable quantities of, produces most remarkable effects.

For example: By the use of the proper light filter he was able to shut off all visible light, but when fabrics dyed with various dyestuffs were put in the range of this ultra-violet radiation some of them became suddenly and brilliantly luminous.

He also demonstrated the formation of color by interference caused by very thin layers of transparent material.

A general discussion followed the talk, during which many interesting points were brought out.

A. K. JOHNSON, Secretary.

BY-LAWS--PHILADELPHIA SECTION

The following by-laws of the Philadelphia Section were approved by the Council at the meeting held in Boston on March 1, 1924:

The name of this organization shall be the Philadelphia Section of the American Association of Textile Chemists and Colorists.

The objects of this organization shall be:

To promote increase of knowledge of the application of dyes and chemicals in the textile industry.

To encourage in any practicable way research work on chemical processes and materials of importance to the textile industry.

To establish for the members channels by which the interchange of professional knowledge among them may be increased.

To promote acquaintance and feelings of good fellowship among the members of this Section.

All active and junior members of the A. A. T. C. C. shall be entitled to membership in this Section and are entitled to vote in all sectional matters, but only active members can be elected to the chairmanship of this Section. Any person who, for some reason or other, does not come under the heading of the above classes of membership, but who is interested in the activities of the Section and desires to take part in the meetings, may do so as a guest of this Section.

A Chairman, Secretary and Treasurer and four members to constitute the Sectional Committee shall be nominated at the first fall meeting and elected at the following meeting.

Nominations shall be made from the floor. A list of nominees may be suggested by a committee appointed by the Chairman for that purpose.

Election shall be by balloting.

Ten members shall constitute a quorum.

In case of vacancy, nominations and election for the balance of the term shall take place at the next stated meeting.

Any member may propose an amendment by addressing the Secretary. At the first regular meeting thereafter the subject shall be discussed, and, if worthy, notice to vote on same shall be posted until the next regular meeting, and written copy of the notice shall be sent to each member. The proposed amendment shall then be discussed in open meeting and can be passed by two-thirds vote of all members of the Section.

The Chairman shall preside at all meetings and is ex-officio a member of the Council of the A. A. T. C. C. In case of absence of the Chairman, the meeting shall be presided over by the Secretary for the business part and the Chairman of the Program Committee for the professional part of the meeting. The Chairman may appoint committees to take charge of special affairs as he may deem advisable.

The Secretary shall keep the minutes of the meeting and shall advise the members from time to time as to the proceedings. The Secretary shall submit to the Secretary of the A. A. T. C. C. an annual report of the proceedings of the Section each year before December 1.

The Treasurer shall look after the financial transactions of the local Section and shall pay all bills approved by the Section out of funds due from contributions from A. A. T. C. C. and sectional dues. The Treasurer shall furnish the Treasurer of the A. A. T. C. C. with an annual account of receipts and expenditures each year before December 1.

Stated meetings of the local Section shall take place every two months, with the exception of the summer months. The date of these stated meetings shall be fixed at the first fall meeting.

A special meeting may be called by the Chairman of the Sectional Committee.

ORDER OF BUSINESS

Regular Meeting

Reading of minutes of last stated meeting.
Miscellaneous announcements.
Reading of papers, discussion, and communications.
Adjournment.

Annual Meeting

Reading of minutes of last stated meeting.
Miscellaneous announcements.
Stated business.
Annual reports.
Election of officers.
Address of retiring President, etc.
Adjournment.

In all questions requiring parliamentary ruling not provided for in the Rules of the Section, "Robert's Rules of Order" shall be the governing authority.

BY-LAWS, JUNIOR SECTION, LOWELL TEXTILE SCHOOL

The following by-laws of the Lowell Textile School Junior Section were approved by the Council at the meeting held in Boston, March 1, 1924:

I

The name of this organization shall be the Lowell Textile Junior Section of the American Association of Textile Chemists and Colorists.

II

The object of this organization shall be:

To unite local Junior members of the American Association of Textile Chemists and Colorists in furthering the aims of the Association and to increase the advantages of membership in the Association to local Junior members.

III

Officers

The officers of this Section shall be: Sectional Chairman; Sectional Vice-Chairman; Secretary, and Treasurer.

The above officers shall constitute the Executive Committee.

The officers shall be elected at the last regular meeting of the school year, by a majority vote of the members present.

IV

Duties of the Officers

The Sectional Chairman shall preside at all meetings and fulfill all duties usually pertaining to this office.

The Sectional Vice-Chairman shall preside in the absence of the Sectional Chairman.

The Secretary shall keep the minutes of all meetings of the Society. He shall post notices of all meetings at least one day before the date of their occurrence, and shall fulfill other duties usually pertaining to this office.

The Treasurer shall keep an accurate account of all financial matters. He shall keep an accurate list of the members and have all accounts audited by the Executive Committee before the meeting at which his term of office expires.

V

The dues of the members of this Society shall be as prescribed by the parent society.

VI

Meetings

Regular meetings shall be held the first Friday of every month during the school year.

The Sectional Chairman, after consultation with the Executive Committee, may call special meetings or change the date of the regular monthly meeting.

VII

In all other matters the Section shall be controlled by the Constitution of the parent society.

APPLICANTS FOR MEMBERSHIP

Active Membership

Benkert, Arthur L., sales manager and secretary. Sponsors: D. P. Knowland and Louis Brigg.

Boger, Robert C., Boger & Crawford, Philadelphia, Pa. Sponsors: B. K. Archer and E. C. Bertolet.

Carey, John H., chemist, Brogan Mills, Anderson, S. C. Sponsors: E. H. Killheffer and Giles Low.

Donaldson, William N., dyer, American Silk Spinning Company, Pawtucket, R. I. Sponsors: R. F. Culver and S. I. Garnett.

Guertin, R. J., superintendent Boger & Crawford, Philadelphia, Pa. Sponsors: B. K. Archer and E. C. Bertolet.

Holst, Jr., William A., dye chemist, National Aniline & Chemical Company, New York, N. Y. Sponsors: H. F. Herrmann and L. J. Matos.

Lagazio, Julius, colorist, J. G. Rutherford & Co., New York, N. Y. Sponsors: William C. Baird and J. C. Tebbetts.

Roche, Raymond V., experimental laboratory supervisor, National Aniline & Chemical Company, Buffalo, N. Y. Sponsors: William F. Deady and Clarence E. O'Connell.

Weber, Edward, manager application laboratories, National Aniline & Chemical Company, Buffalo, N. Y. Sponsors: W. M. Scott and J. J. Sokolinski.

Junior Membership

Finkel, Louis, dyer, Royal Silk Dyeing Company, Philadelphia, Pa. Sponsors: P. Theel and E. C. Bertolet.

CHANGES OF ADDRESS

Biach, Ludwig, Dr., 981 Smith Street, Providence, R. I.

Crowell, Prince S., Enterprise Dye Works, Woonsocket, R. I.

Frazer, Maurice D., Renfrew Manufacturing Company, Adams, Mass.

MacIntyre, J. F., c/o Southern Manufacturers' Club, Charlotte, N. C.

Morrison, A. W., Medford, Mass.

Purcell, James, Rockaway, N. J.

Thomas E. Kidd, Box 876, Stamford, Conn.

Wooffindale, W. H., Longmeadow, Mass.

ASSOCIATION BADGES

Those who attended the Annual Meeting of Providence had an opportunity to examine and purchase the new lapel button badges which were there distributed by the Secretary.

For the benefit of members who were unable to attend the meeting an illustration of the badge is shown herewith.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

WALTER E. HADLEY,
5 Mountain Avenue,
Maplewood, N. J.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

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THE GARVAN DINNER

ON page 201 of this issue of The REPORTER appears a preliminary announcement of a dinner to be tendered Francis P. Garvan on April 26th as a testimonial to the services he has rendered the American chemical industry.

This testimonial is eminently merited and should receive the enthusiastic support of all elements in the chemical field. As the leading spirit in the formation, and later president, of the Chemical Foundation, Inc., Mr. Garvan has brought to his work an inexhaustible supply of loyalty and enthusiasm which has been of inestimable value to the chemical interests of this country and, through them, to the public at large.

Throughout the course of the recent trial at Wilmington Mr. Garvan was the center of a storm of vituperation and invective which, despite its bitterness and injustice, failed to pierce the armor of his patriotism or shake for a moment his determination to fight to the end for American chemical independence.

The REPORTER sincerely hopes that all of its friends and readers will make every effort to be present on April 26th to swell the ranks of those who gather to pay a fitting tribute to this great American.

THE COMING BOOM IN TEXTILES

THOSE in the textile industry who feel disheartened over the inactivity of the mills and who are beginning to regard the situation as being "in one big mess," as one trade publication expressed it, would do well to weigh and consider business conditions in other industries. They would see, in the first place, that this "mess" is tied securely to every other line of business —tied so that when business expands generally and begins to rise it ought, by all natural and economic laws, to pull the "mess" up with it.

An excellent method used by economists to explain clearly this close relationship existing among all industries is to trace back the effects of a single purchase made by a symbolic consumer designated simply as Mr. Public. The method shows how the sale of a suit of clothes puts in motion a dozen different industries; how the merchant orders additional stock from the wholesaler, who in turn orders from the mill, which consequently must replenish its own stock of raw materials; and how each one of these units depends for a normal existence upon countless other industries, so that the whole represents the interlaced, crisscrossing web of modern business. It follows logically that if a section of the web becomes weak it must derive new strength from the whole.

Business now is normal and healthy. The encouraging forecasts that appeared in the press at the beginning of the year were practically unanimous in declaring that during 1924 it would swell to most satisfying proportions. Nearly all industries are working at or near capacity; production and distribution figures indicate a very encouraging increase. While everything else has been moving forward on this wave of greater production and greater prosperity, textile mills have been running far below normal, laying off help and even shutting down altogether.

During the early part of this sluggish period in textiles an outbreak of pessimism added its weight to the general gloom in mill district and elsewhere. But the pessimist either overlooked the promising healthy conditions in all other industries or he failed to consider the effect that these general conditions would finally have on the textile trade. In fact, if he were sufficiently far-sighted to acknowledge that a *general* increase in business is bound after a time to exert its salutary influence upon a single dull industry he would not be a pessimist. He merely failed in this case to recognize the economist's simple illustration of how closely related the textile industry is to all other branches of industrial activity.

The industry has not settled down for a long depression, as some may believe. It is only suffering from a temporary lull. It has been lying inert at the bottom of a sharp slump, with its face turned away from the rise ahead. The boom is merely delayed.

The delay is due to conditions peculiar to the industry—conditions, therefore, that cannot last. One authority, speaking of unsettled cotton market conditions, stated that sellers misjudged the financial situation at the end of last year and advised the mills to buy—to prepare for an increase in demand. This increase failed to materialize. Consumers were resisting high clothing prices caused by high raw materials, and this jammed the regular flow of stocks of winter clothing. Stocks accumulated; mill production slackened; sales dropped far below normal. Some mills stopped their spindles for an indefinite period; others reduced production to the minimum. The urge to resume normal production was manifestly lacking and idleness resulted. English textiles, shipped here in larger quantities than ever before, were entered in active competition with the dribbling output of New

England mills, and this extremely unfavorable circumstance, coupled with severe competition from the South, tended to make conditions in New England appear hopeless.

But improvement is imminent. Pessimism has diminished considerably; better conditions are anticipated before April. Stocks are moving faster, although manufacturers are squeezed by low prices and slight profits. Later news tells of increased business in all textile lines. Many mills throughout New England are installing automatic looms and completing additions to their plants; some of the larger mills are running again on close to normal schedule. Increase in public demand, with consequent increase in production, is inevitable.

That the public controls textile production by its attitude toward retail prices is acknowledged and has been confirmed by the decline. But this conclusion only leads us back to the bright outlook in all other markets. The public's response to prices is swayed by its financial misfortune or financial prosperity, as the case may be. These in turn are brought about by the general business situation. If general business is better, as we have said, then the spirit of prosperity will soon be felt by consumers, retail clothing stocks will disappear and the expansion will reach the mills. Meanwhile the pessimist will be working furiously on a ponderous volume which he will probably call "Hard Facts About Hard Times." When this is ready for distribution to the textile trade he will realize, with pessimistic dismay, that the "hard times" have become mere history—the sort that makes very undesirable summer reading.

T. C.'S COLUMN

THE TECHNICAL DYE SALESMAN

In meeting dye salesmen from day to day the question often pops into mind, "Why don't they send out somebody that knows something about dyes?" Many of the men do know what they are talking about, are a pleasure to meet because they know the dyer's problems, and can often give helpful suggestions. Perhaps it is not found so in practice but one would expect them to get the cream of the business.

Others can scarcely tell a pound of dye from a tin of coffee, and on their calls merely clutter up the office and waste others' valuable time. They are all shades of youth and age and experience, and their choice of the work has apparently had no connection with any system of any laws (natural or synthetic).

Should the choice be based on salesmanship or knowledge? Can a good salesman sell *anything*, or are dyes an exception? Which counts the most, a pleasing and persuasive personality or a grist of facts about dyes: their pre-war names, good-working combinations and special uses?

The proper application of dyes is one of the most technical of the arts. Success depends upon a thousand details and much of the time we scarcely know why. Dyes are as different as people. We have white folks, and black folks, and red and brown and yellow, but still no two individuals that act alike in all circumstances. It taxes our ingenuity to get results with even the best of dyes, but it does help to be told how the new ones compare with the old or what more can be expected of them, or to perhaps get a hint as to why something has come out as anticipated.

In the selling of dyes one tendency seems to be to sell the goods and let the buyer find out what they are. Where buyers are working out specialties they naturally prefer this, and in fact under any circumstances the buyer has to determine some things for himself.

Another tendency is to build up a clientele or even a business on *service*. The buyer is shown in detail just how to do certain parts of his work. In some cases this has been overdone. In others it is a real help to the user although he may not understand what he is doing or why.

A compromise seems most desirable. The dye salesman that understands the technical features of his dyes, and of the most common dyeing operations, and understands enough of general theory and practice to intelligently discuss them and even to solve special problems, can serve any of his customers to suit their own ideas to the great advantage of his firm.

Many small dyers, no doubt, do better to buy their dyes and service all in one package. Larger firms can afford laboratory inspection of supplies and in those fortunate places where the purchasing agent does not think that he is the only honest man in the corporation, and where the chemist understands mill conditions as well as routine dye tests, both he and the dyer can meet the right kind of dye salesmen and discuss problems and requirements to the benefit of all concerned.

Some of the best textile chemists in the business are connected with dye firms, and, if we can call them chemists at all, some of the poorest. For some reason the real chemists are seldom salesmen. They are either not considered quite up to the task, or perhaps it is because there are not enough to go around.

Is there not here a field for textile chemists? It is no place for a man with a smattering of knowledge and a handy collection of catch-words, but the field should offer real rewards for the man who goes seriously into it and sticks. The personality must be there because knowledge alone does not sell things. The knowledge should be there, too, and it can only be acquired by real dyehouse work in a variety of mills, accompanied by a diligent study into the why and wherefore of everything that is done during dyeing (or printing) as well as before and after. At first the work will be hard and the reward small, but it should ultimately yield good returns in material things and in personal satisfaction. T. C.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered.]

PIGMENT CHLORINE
(Schultz No. 8)

FASTNESS TO LIGHT: Very poor.

REMARKS: This dye is insoluble in water. The shade is a bright greenish yellow. Its fastness to light is so poor that it cannot be used as a pigment color. It is not fast to water or acid, but is fast to alkalies. It is soluble in spirit, but almost insoluble in oil.

COMPETING PRODUCTS: Made in the United States by the Ultro Chemical Company.

DIRECT YELLOW R
(Schultz No. 9)

COMPOSITION: Stilbene type.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: In a bath of common salt at the boil.

SHADE: Golden yellow.

SOLUBILITY: Good.

LEVEL: Dyes level very easily.

EXHAUSTS: Very slowly.

FASTNESS TO:
- **Acid:** Excellent fastness.
- **Alkali:** Fairly fast.
- **Chlorine:** Very good fastness.
- **Ironing:** Excellent fastness.
- **Light:** Excellent fastness.
- **Rubbing:** Excellent fastness.
- **Steaming:** Very good fastness.
- **Washing:** Very good fastness.
- **Water:** Good.

SENSITIVE TO METALS, LIME: Sensitive to copper, which makes the shade redder and duller.

MACHINE DYEING: Suitable for machine dyeing.

OTHER PROPERTIES: Used with Diazo Black BH Extra in the manufacture of aniline speck dyes to be used on white silk effect goods.

DYED BY OTHER METHODS: Dyes cold in as satisfactory manner. After-treatment with chrome and copper does not improve the properties.
- **Pad Dyeing:** Suitable, but exhausts so slowly that it is not suitable for use in combination with other dyestuffs.
- **On Unions:** Cotton-silk—dyes only the cotton; wool-silk—no interest.

ON OTHER MATERIALS:
- **Paper:** On pulp the backwater is nearly clear. Suitable for unsized paper and for wall-paper paste colors.
- **Lakes:** Fast to lime. For lime colors use barytes and barium chloride.
- **Oil Paints:** Covers poorly, but is fast to oil.
- **Lithographing Inks:** Suitable; stands lacquering.

PRINTING: Suitable for printing on cotton.

DISCHARGING: Chlorate discharge not suitable. Hydrosulphite discharge not suitable. Color discharges not suitable.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dye & Chemical Works (Selling Agents, John Campbell & Co.); American Aniline Products Corporation; Cincinnati Chemical Works; Essex Aniline Works (Selling Agents, Grasselli Chemical Company); Garfield Aniline Works (Selling Agents, U. S. Color & Chemical Company); National Aniline & Chemical Company; Newport Chemical Works; Peerless Color Company, Inc.

CHLORAMINE ORANGE G
(Schultz No. 11)

COMPOSITION: Stilbene or Mikado group.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: In a bath of common salt at the boil.

SHADE: Yellow shade orange.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Good.

LEVEL: Dyes level easily.

EXHAUSTS: Very slowly.

FASTNESS TO:
- **Acid:** Good to acetic acid only.
- **Alkali:** Good.
- **Chlorine:** Very good fastness.
- **Fulling:** Fair fastness in a neutral fulling.
- **Ironing:** Shade goes yellower.
- **Light:** Excellent fastness.
- **Perspiration:** Satisfactory.
- **Rubbing:** Satisfactory.
- **Sulphur:** Good fastness.
- **Washing:** Good fastness.
- **Water:** Good fastness.

MACHINE DYEING: Suitable.

OTHER PROPERTIES: Used as a component of aniline speck dyes.

DYED BY OTHER METHODS: Suitable for pad dyeing. Dyes cold.

ON UNIONS: Cotton-wool—the wool is carcely affected; cotton-silk—in a soap bath the silk is left white.

ON OTHER MATERIALS: On silk the color exhausts well and is fast to water.

DISCHARGING: Gives a white discharge with zinc dust and a cream discharge with tin crystals.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dye & Chemical Works (Selling Agents, John Campbell & Co.); American Aniline Products Corporation; Essex Aniline Works (Selling Agents, Grasselli Chemical Company); National Aniline & Chemical Company; Newport Chemical Works.

XYLENE YELLOW
(Schultz No. 22)

COMPOSITION: Pyrazolone type.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric.

SHADE: Similar to Fast Light Yellow 3G.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Very good.

LEVEL: Inferior to Fast Light Yellow 3G.

EXHAUSTS: Well.

PENETRATION: Good.

FASTNESS TO:
Acid: Good.
Alkali: Redder.
Carbonizing: Redder and duller.
Fulling: Moderate; bleeds badly.
Light: Faster than the Fast Light Yellows.
Perspiration: Good.
Rubbing: Good.
Steaming: Redder.
Sulphur: Good.
Washing: Fair; goes redder.

SENSITIVE TO METALS, LIME: Sensitive to iron, the color changes to a dirty green. Copper reddens the shade.

OTHER PROPERTIES: Very fast to salt water and used in dyeing of woolen bathing suits.

ON UNIONS: White cotton effects are not stained.

ON OTHER MATERIALS: Dyed on gloria, the silk is left almost white. On weighted silk the Xylene Yellow is brighter and greener than the Fast Light Yellow 3G.

PRINTING: In silk printing it is not as fast as Fast Light Yellow 3G. In wool printing the properties are the same as Fast Light Yellow 3G.

COMPETING PRODUCTS: Made in the United States by Pharma-Chemical Corporation; Cincinnati Chemical Works; E. I. du Pont de Nemours & Co.

TARTRAZINE
(Schultz No. 23)

COMPOSITION: Pyrazolone type.

SPECIALLY SUITABLE FOR: Wool dyeing.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Similar to Naphthol Yellow S.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Very good.

LEVEL: Can be added at the boil with care.

FASTNESS TO:
Acid: To acetic, good; redder with dilute sulphuric. Equal to Azo Yellow (S-141) in this respect.
Alkali: Fast.
Carbonizing: Fast.
Cross-Dyeing: Not fast enough.
Fulling: Loses body and bleeds somewhat.
Ironing: Fast to ironing.
Light: Fairly fast; not as good as Fast Light Yellows; better than the Indian Yellows.
Perspiration: Poor fastness.
Rubbing: Fast.
Steaming: Fast.
Sulphur: Fast.
Washing: Not fast.
Water: Fairly fast.

SENSITIVE TO METALS, LIME: Iron has no effect on the shade.

OTHER PROPERTIES: Used in combination shades on ladies' dress goods.

DYED BY OTHER METHODS: Suitable for shading top-chrome colors. After-chroming with 20 per cent acetic leaves the silk white in silk effects.

ON UNIONS: Cotton-wool dyed acid—cotton unstained; cotton-wool dyed neutral—no interest; cotton-silk dyed acid—cotton hardly stained.

ON OTHER MATERIALS:
Silk: Boiled-off liquor and sulphuric; not fast to water or washing.
Cotton (with alum and Glauber salt): Of no interest.
Paper: Not recommended.
Suitable for dissolving in a shellac-borax solution.

PRINTING: The color prints easily level and is fast to sulphur and carbonizing on gloria. Prints on either wool or silk with acid.

DISCHARGING: Hydrosulphite gives a white discharge.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.; Calco Chemical Company; Grasselli Chemical Company; Hirsch Laboratories; National Aniline & Chemical Company; Pharma-Chemical Corporation; Texdel Chemical Company; Textile Chemical Company.

REMARKS: Especially useful for combination shades on yarns and pieces in combination with Azo Fuchsine, Alizarine Saphirol, etc.

ERIO CHROME RED B
(Schultz No. 29)

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant or top-chrome. Best results on a mordant.

SHADE: Bluer than Cloth Red B (S-233).

SHADE BY GASLIGHT: Yellower.

SOLUBILITY: Forty parts per thousand.

LEVEL: Moderate, though better than the Cloth Reds.

EXHAUSTS: Well.

PENETRATION: Good.

FASTNESS TO:
- **Acid:** Good to organic acids. Redder with sulphuric.
- **Alkali:** Fast.
- **Carbonizing:** Fairly fast.
- **Fulling:** Good when top-chromed; moderate on a chrome mordant.
- **Ironing:** Fast.
- **Light:** Fast enough for men's wear.
- **Potting:** Same as Cloth Red B (S-233).
- **Rubbing:** Fast.
- **Steaming:** Fair shade; goes lighter.
- **Sulphur:** Fast.
- **Washing:** Fast top-chrome. Bleeds a little on chrome mordant.

SENSITIVE TO METALS, LIME: Copper and iron affect the shade severely.

OTHER PROPERTIES: The color precipitates with acid, and the dyeing, therefore, must always be started with acetate of ammonia.

DYED BY OTHER METHODS: Dyed acid, a yellowish red is obtained which if after-treated with fluoride of chrome turns toward brown. The product dyed top-chrome is only half as strong as on a chrome mordant.

ON UNIONS: Cotton effect threads remain white when dyed chrome mordant or top-chrome. Silk effect threads are stained.

ON OTHER MATERIALS: Artificial silk is left white.

PRINTING: No interest.

DISCHARGING: No interest.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.

CHRYSOIDINE Y
(Schultz No. 33)

COMPOSITION: Monoazo basic.

ESPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: On a tannin mordant. It can also be used for topping direct cotton colors or cutch.

SHADE: Yellowest of the colors of this class.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Forty parts per thousand. Best at 140 deg. Fahr. with a little acetic decomposed at a boil.

LEVEL: Fairly good.

EXHAUSTS: Not quite.

FASTNESS TO:
- **Acid:** Fair fastness.
- **Alkali:** Not fast; goes yellower with ammonia.
- **Chlorine:** Destroyed.
- **Cross-Dyeing:** Not fast.
- **Ironing:** Fast.
- **Light:** Average for this class of colors.
- **Rubbing:** Fast.
- **Washing:** Not fast.
- **Water:** Not fast.

DYED BY OTHER METHODS: Padded on cotton and coupled with diazotized para, it gives dark browns.

ON OTHER MATERIALS:
- **Silk:** The shade is not fast to water.
- **Paper:** A good substitute for cutch. Dyes deepest on bleached pulp.
- **Wool:** Dyes neutral; fastness to fulling very poor.

PRINTING: The white is stained.

DISCHARGING: Hydrosulphite a pure white.

COMPETING PRODUCTS: Made in the United States by Calco Chemical Company; Central Dyestuff & Chemical Company; E. I. du Pont de Nemours & Co.; Grasselli Chemical Company; The Heller & Merz Company; National Aniline & Chemical Company.

THE PHOTOCHEMICAL DECOMPOSITION OF OXALIC ACID

(Continued from page 188)

insure obtaining reliable data for comparative purposes it is essential to standardize all containers by means of simultaneous exposure tests.

5. It is probable that the temperature coefficient of the reaction is small, although further evidence on that point is desirable.

6. Ultra-violet radiant energy is particularly effective in catalyzing the reaction.

The reaction has been employed somewhat extensively in the study of the relative actinism of sunlight in various localities, although it is probable that variations in the technique of the different collaborators have impaired the value of the comparative data obtained.

It is of interest to note that the occurrence of actinic and non-actinic days (or days in which the actinity of the sunlight is decidedly greater or less than is normal for days of apparently identical atmospheric conditions) was thoroughly established. It was repeatedly demonstrated (Manila), moreover, that the actinism of sunlight did not reach a maximum at noon, as would be expected from a consideration of the angle of incidence of the sun's rays to the atmosphere, but that it increased well into the

afternoon so that the light of the early afternoon was decidedly more actinic than that of the late forenoon.

The reaction will record the variation in intensity of artificial lights with variation in current, and measure their deterioration in protracted use. Where a light is mounted over a table upon which dyed samples are to be tested for fastness, the reaction may be utilized in standardizing the various portions of the exposure field. It will then be possible to carry out simultaneously exposure tests on a large number of samples, varying the period of exposure in such degrees as are necessitated by the demonstrated variations of light intensity in the different portions of the field. It appears probable that further utility may be found for the reaction in connection with the investigation of the light-fastness of dyes in view of the possibility of varying its rate over very wide limits and of the accuracy with which it may be measured.

USE AMERICAN DYES!

A strong appeal for the preference of American dyes over foreign products was contained in an address delivered at the dinner of the Purchasing Agents' Association, March 13th, at the Hotel Bellevue-Stratford in Philadelphia. William F. Van Riper was the speaker. He urged that purchasing agents in textile mills should specify and select from American-made colors; that such support of our industry will contribute considerably toward its steady growth during these peace times so that we shall be sufficiently prepared to turn out great quantities of munitions in the event of war. In short, every time a mill thoughtlessly places an order for a German dye that mill not only strengthens foreign war resources but weakens a vital American industry—one that shall loom as a big factor in any war.

A letter distributed by the American Chemical Society outlines the most important features planned for the big spring meeting of the society to be held in Washington, D. C., April 21 and 26. Hundreds of papers dealing with chemistry and allied subjects will be read by groups of distinguished chemists and scientists representing leading universities and technical schools, industrial enterprises and governmental departments. The comprehensive series of discussions includes papers on hygienic problems, petroleum, paints and varnishes and chemical education and research. The time not devoted to these lectures will be taken up with business sessions and an elaborate entertainment program including a reception at the National Museum, luncheon at the George Washington University and a trip to Mt. Vernon.

The American Printing Company, Fall River, Mass., has elected officers for the ensuing year as follows: President, Bertram H. Borden; treasurer, Howard S. Borden; assistant treasurer, Nathan Durfee; directors, B. H. Borden, H. S. Borden and N. Durfee.

DYEING CHAMOIS LEATHER

The term "chamois" is a misnomer to-day; for although this leather was originally prepared from the skin of the chamois of southern Europe, it is now made from sheepskin, and the term refers to the process and not to the actual leather. The part of the sheep used for "chamois" is the under skin, which until recently was discarded as being of no value. At one time doeskin was also used for making "chamois" gloves, but doeskin has a value of its own and is not often employed now in the preparation of chamois leather.

When sheepskins arrive at the glove factory they are first scraped with a knife, and then passed over a swiftly revolving emery-wheel. The skins are then thoroughly soaked in oils and soapsuds, after which they are bleached by being hung on racks in the open air. The next process is coloring, and as chamois leather is dressed with oil it does not readily absorb dye. But some beautiful shades of gray and brown are produced, and manufacturers are constantly experimenting to improve their methods.

After dyeing, the skins are put into drying chambers, where they become hard; so when taken out they have to be reduced again to their natural softness, which is done on the emery-wheel. The skins are finally beaten, and then sent into the sorting shop, where the best are selected and made up into gloves.—The Irish Draper.

PONTAMINE FAST BLUE 2GL

E. I. du Pont de Nemours & Co. announce, as an addition to their line of Pontamine Fast Blues, a new product under the name of Pontamine Fast Blue 2GL which in shade is about half-way between Pontamine Fast Blue SLN and Pontamine Fast Blue 4GL. The product penetrates well, dyes evenly, and can be used for dyeing loose cotton, yarns or piece goods, especially when material is to be used for tapestry, velvets, etc., where good fastness to light is a requirement. It is also quite fast to alkali, acetic acid and rubbing.

It may be used with other after-treated colors, because its shade is not affected by this treatment, which, however, does not increase its fastness. It is also offered for use on pure and tin weighted silk for producing shades fairly fast to water and light, if applied from an acetic acid broken soap bath.

For half-silk materials Pontamine Fast Blue 2GL produces very clear greenish shades on cotton, leaving silk unstained, if dyed from a very faintly alkaline Glauber salt bath. It is easily discharged to a pure white with sulphoxylates.

On paper it is faster to light than many other Direct Blues, even when such blues are after-treated with copper sulphate.

Technical Notes from Foreign Sources

Combination Between Fibers and Dyestuffs

An interesting article is published in the Kolloid Zeitschrift, volume 33, pages 306 to 309, on the adsorption compounds that are formed between certain fibers and certain dyestuffs. It was found that when cotton fibers are dyed in suspensions of indigo to a grayish blue color which is not much affected by the presence of sodium bisulphate in the dye bath, practically all of the dyestuff can be removed from the fiber by merely washing the latter with water. This indicates that the particles of indigo are very loosely held by the cotton fiber.

An experiment was then made with the woolen fiber which was dyed in the same dye liquor. It was seen at the outset that the woolen fiber absorbs the dyestuff much more rapidly and in a far greater proportion than the cotton fiber. The result is that when the wool is subjected to strong washing with water, little of the color is removed from the fiber. The presence of the salt, sodium hydrogen sulphate, in the dye bath results in a much deeper color and also in a much more homogeneous dissemination of the dyestuff throughout the fiber.

Another experiment was also made with Alizarin VI which was used in an aqueous suspension. The cotton fiber was dyed with this dyestuff and here again it was found that the dyestuff did not adhere to the fiber to any great extent and that the color could be removed from the cotton fiber by repeated washing with water. But when a little sodium bisulphate is added to the dye bath, the fiber adsorbs considerably more of the dyestuff and is colored a brownish yellow. The adsorption composition that is formed with the cotton fiber under these conditions is much more stable, and even after repeated washing with water the cotton fiber is still colored a pale yellow. As may be expected, an even stronger adsorption was obtained when wool was dyed in the bath. The color of the woolen fiber was violet, but chrome yellow when sodium bisulphate was present in the dye liquor.

Hexalin Soaps as Detergents in Bleaching and Dyeing

Hexalin is a product that is made by the hydrogenation of phenol. Its chemical name is hexahydrophenol. This substance as well as the methyl derivative, which is known as methyl-sexalin, has been used in Germany in the manufacture of textile soaps which are claimed to possess superior properties to the soaps commonly used for textile purposes. Both hexalin and methyl-sexalin are soluble in aqueous solutions of soap, and when they are added to the same they possess the power of bestowing certain solvent and emulsifying properties on the product which make it very useful for dissolving and removing hydrocarbons, their halogenated derivatives, oils and fats, tars, oils and greases, that have become blackened while being used for lubricating purposes; asphalts, waxes, albuminous matters, and the like from textile materials with which they accidentally come in contact. An important feature is that water containing calcareous matter does not precipitate these solvents.

They possess many applications in dyeing and bleaching practice. In an emulsion with mineral oils they are used in sizing wool. Hexalin soaps are used with considerable economy in soap consumption as well as fuel consumption, due to the low temperature at which the soaps are employed. The odor of these solvents is not disagreeable, being similar to that of camphor. Hexalin and methyl-hexalin soaps are used in the form of solid blocks of soap, in solution form, as well as in the state of soft soap.

For further details the reader is referred to Textilechem. und Color., No. 8, pp. 53 to 55 (1923).

Dyeing Cellulose Acetate

British Patent No. 194,244 is concerned with a process of dyeing artificial silk made from cellulose acetate. The acetate silk is treated with a concentrated solution of common salt, and then subjected to the action of saponifying agents. The latter operation is conducted in the cold. It is also possible to add a little of the saponifying agent to the solution of common salt in order to produce a superficial saponification only.

For example, the acetate silk is treated in a solution of common salt containing 25 per cent of the salt, to which about one-half of 1 per cent of sodium hydroxide has been added. After impregnation, the silk is freed from the adhering liquid and allowed to hang in dry lofts which are maintained at room temperature. Then the silk, which has dried out, is subjected to the saponifying action of a 0.25 per cent solution of caustic soda and thereafter it is dyed in the usual way.

It is also possible to digest the silk in a 25 per cent common salt solution for about ten minutes, and then it may be saponified with the aid of a 5 per cent solution of caustic soda. In place of the solution of common salt, it is also possible to obtain good results with the aid of solutions of calcium chloride or magnesium chloride. Hydroxides of the alkaline earth metals may be employed in the place of potassium or sodium hydroxide.

Strengthening Artificial Silk Fiber

German Patent No. 382,086 is concerned with a process of increasing the strength of the artificial silk fiber, especially when it is wet. The artificial silk fiber is treated with aldehydes. Particularly with an aqueous solution of formaldehyde, and then the fiber which has been sub-

jected to this preliminary treatment is heated up to temperatures varying between 100 and 160 deg. Cent. The heating operation is carried out in an atmosphere of inert gas, for example, in an atmosphere of hydrogen nitrogen, etc.

In place of the formaldehyde dipping treatment the fibers may be subjected to the action of formaldehyde vapors. It is also advisable to carry out the formaldehyde treatment of the artificial silk fiber with the actual manufacturing operation by the use of coagulating preparations to which formaldehyde is added

INTERESTING EXHIBITS TO BE FEATURED AT THE KNITTING ARTS EXHIBITION

VISITORS at the Twentieth Annual Knitting Arts Exhibition to be held at Philadelphia during the week of April 7th are assured of an exceptionally interesting and instructive program. The exhibitors have been expending great energy and skill in planning exhibits that will be of unusual interest and real educational value to both textile and dyestuff men and the general public. Innumerable varieties of textile equipment and appliances will be on view.

The exposition has been planned with the definite purpose of showing by actual display the rapid, steady progress that is a deservedly commendable feature of the knit goods industry.

As in previous years the exhibition will be the scene of a large gathering of all the most active units in the hosiery and underwear trade and in the textile field generally. Textile executives from every big manufacturing center, dyeing and finishing equipment representatives and many in the dyestuff and textile chemical industry will travel to Philadelphia that week to meet, to discuss business and to take part in the numerous activities—meetings, lectures and entertainments—that form a noteworthy feature of every Knitting Arts Exhibition.

A number of dye and chemical firms will exhibit their products and endeavor, by personal discussions and the distribution of booklets and folders, to spread knowledge of the industry's important place in the knit goods trade.

The National Aniline & Chemical Company, Inc., will be represented in Spaces 57, 58 and 59 by an extensive display of mill dyed knitting yarns and knitted textiles. This exhibit will be unique in its presentation, in that the goods will be shown behind glass, suitably illuminated, to give the general appearance of a display window.

Careful attention will be given to the color effect in this window, and it is believed that the display will present a distinctive appeal to all visitors. The goods shown will consist of stockings, of cotton, wool, silk, artificial silk and commercial mixtures of these fibers, of underwear, bathing suits, glove fabrics and other knitted materials—each illustrating the latest developments in knit goods dyeing.

The March issue of Dyestuffs, the company magazine, will be distributed at the National Booth. It will contain articles and illustrations of special interest to all knitting mill men.

The Mathieson Alkali Works' exhibit will be located in Booth No. 252 and will be in charge of W. D. Marshall, Philadelphia District Sales Manager, assisted by W. A. Field, Jr.

They will display a model showing the Mathieson system of preparing sodium hypochlorite bleach liquors from liquid chlorine. One of the important features of the Mathieson system is the use of predetermined units of liquid chlorine, insuring the production of uniform bleach liquors in any quantity desired. Literature describing the use of Mathieson chemicals in the textile industry will be available, and samples will be shown of "Eagle Thistle" caustic soda, soda ash, bleaching powder, bicarbonate of soda and modified Virginia soda.

The International Nickel Company, miners and refiners of Monel metal, will occupy Booths Nos. 70 and 71. The background of the booth will be polished Monel metal sheet and the booth will be enclosed by a nickel railing. No attempt will be made to display Monel metal dyeing machinery, as every manufacturer of hosiery dyeing machinery will display Monel metal equipment. An Attracto-Scope will show views of installations in textile plants throughout the country. The exhibit will be in charge of E. A. Turner of New York.

The Tolhurst Machine Works of Troy, N. Y., hydro-extractor specialists since 1852, will exhibit a 40-inch self-balancing direct motor driven extractor, specially arranged and equipped to meet the requirements of the textile and allied industries.

This machine will be constructed with a cast iron case, and the basket will be made with a bronze top ring, perforated copper side sheet bound with wrought iron hoops, cast iron basket, bottom covered on the inside with sheet copper and all inner copper surfaces of the basket will be tinned. The spindle will be protected by a tinned copper tube.

In attendance at the Tolhurst booths throughout the period of the show will be their vice-president, W. C. Dutton; sales manager, R. K. Cheney; industrial engineer, T. M. Stuart; John McKeon and Earl D. Rhodes.

Other concerns in the dyestuff or textile-chemical line who will exhibit, but in regard to whose displays we have no detailed information, are as follows:

American Laundry Machinery Company, dyeing machines; Andreykovics & Dunk, dyestuffs; Cooper Hewitt Electric Company, fading lamps; E. I. du Pont de Nemours & Co., dyestuffs; Fletcher Works, extractors; Hussong Dyeing Machine Company; Klauder-Weldon Dyeing Machine Company; Oakley Chemical Company, detergents; Smith, Drum & Co., dyeing machines; Tolhurst Machine Works, extractors; Walker & Davis, Inc., dyeing machines: Jacques Wolf & Co., textile chemicals.

TESTIMONIAL DINNER TO F. P. GARVAN

In recognition of the distinguished services of the Hon. Francis P. Garvan to the cause of chemistry in America, a testimonial dinner will be given at the Waldorf-Astoria, New York City, Saturday evening, April 26, 1924.

Invitations to the dinner are being issued in the names of the presidents of the following national organizations: American Chemical Society—Dr. Leo H. Baekeland, president; American Electrochemical Society—Arthur T. Hinckley, president; American Institute of Chemical Engineers—Dr. Charles L. Reese, president; American Association of Textile Chemists and Colorists—Dr. Louis A. Olney, president; Manufacturing Chemists' Association—Elon H. Hooker, president; Salesmen's Association of the Chemical Industry—Ralph E. Dorland, president; and the Synthetic Organic Chemical Manufacturers' Association—Dr. Charles H. Herty, president.

At a recent meeting of the representatives of these organizations Dr. Charles H. Herty was appointed chairman of the committee on arrangements and A. V. H. Mory, of the American Chemical Society, will act as treasurer.

This dinner will be the closing feature of a week of unusual chemical activities. The American Chemical Society, with a membership of fifteen thousand, will hold its annual spring meeting during the week of April 21-25, in Washington, and the American Electrochemical Society, with a membership of two thousand, will hold its spring meeting April 24-26, in Philadelphia. Both societies have been invited by Gen. Amos A. Fries, head of the Chemical Warfare Service, to visit Edgewood Arsenal on Saturday, April 26, to inspect the grounds and buildings, and to witness in the afternoon an outdoor demonstration by this important division of the United States Army.

The Pennsylvania Railroad has arranged a special train to bring the visitors at Edgewood Arsenal direct to New York in time for the dinner to Mr. Garvan.

It is expected that this gathering will bring together not only representatives of the various branches of chemistry, both from the universities and the industries, but will also be attended by large groups from other professions and organizations with which Mr. Garvan has been in close touch, including representatives of the legal and medical professions, the judiciary, educators, and leading members of women's organizations.

Guests may subscribe for individual covers or may reserve tables arranged for ten persons. Checks covering the subscription price of $6.00 per cover should accompany all reservations. Make checks payable to A. V. H. Mory, treasurer, and mail to 1 Madison Avenue, Room 313, New York City. Subscribers desiring to sit with other guests, though not reserving a complete table, should indicate their wishes. Names for the seating list must be received not later than Friday, April 25th. Ladies are invited and the affair will be formal.

CHARLES H. HERTY, Chairman.

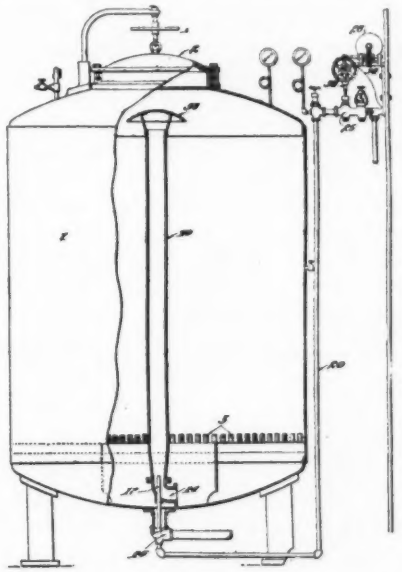
RECENT PATENTS

Vomiting Kier

(1,482,795; February 5, 1924)

Eugene D. Jefferson, Boston, Mass.

A vomiting kier having, in combination, a vessel for containing the goods to be treated and the liquor for acting on the goods, a vomiting pipe connecting the top and bottom portions of the kier, a steam injector



for operating the vomiting pipe to convey liquor from the bottom of the kier to the top thereof, and an automatically operated valve for intermitently opening and closing the steam supply for the injector to vomit predetermined small quantities of liquor at frequent whether the liquor level in the kier be high or low.

Dye and Process of Making the Same

(1,483,798; February 12, 1924)

Arthur George Green and Kenneth Herbert Saunders, Manchester, England, assignors to British Dyestuffs Corporation Limited, Manchester, England.

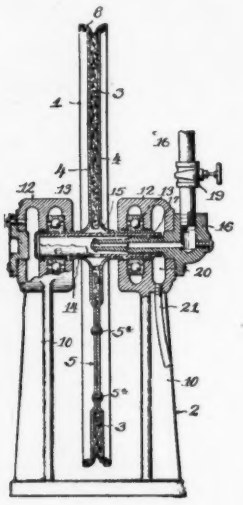
The new dyestuff particularly adapted for dyeing acetyl cellulose, being an amido-azo dye not containing more than two diazo groups solubilized by association with one amino group thereof of aldehyde and bisulphite groups and still containing said groups, and containing a further amino group, said dye being soluble in water to form solutions which slowly decompose when acidified and heated, setting free formaldehyde and sulphur dioxide and yielding an amido-azo compound derived from paraphenylene-diamine and cresidine capable of being readily taken up by acetyl cellulose and dyeing the same.

Dyeing Machine

(1,483,263; February 12, 1924)

Edward Allen, Chicago, Ill. Filed December 1, 1922.

In a dyeing machine, the combination of a wheel provided with spaces extending radially from its axis and



around its periphery, means for supplying dye to said space adjacent and axis, and a layer of absorbent material in said space.

Process of Preparing Triphenylmethane Dyes

(1,483,233; February 12, 1924)

Joseph R. Minevitch, New York, N. Y., assignor to Dicks, David & Heiler Company, New York, N. Y., a corporation of Delaware.

The method of preparing organic dyestuffs of the triphenylmethane series which comprises dissolving the leuco base of the dyestuff in acetic acid of more than about 75 per cent strength and oxidizing said base with lead peroxide in the absence of mineral acid.

Dyeing and Printing Acetyl Silk and Materials Containing It

(1,483,797; February 12)

Arthur G. Green and Kenneth H. Saunders, Manchester, England, assignors to British Dystuffs Corporation Limited, Manchester, England.

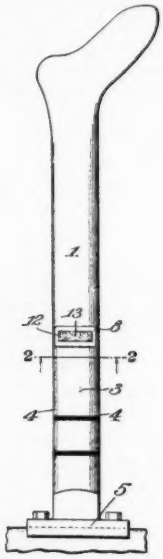
In the dyeing, including printing, of acetyl cellulose, the process which comprises rendering an amido-azo dye soluble in water by a treatment of such dye with an aldehyde and a bisulfite and breaking up the new soluble combination so formed in the presence of the acetyl cellulose to be dyed.

Hosiery Drying and Shaping Structure

(1,485,385; March 4, 1924)

Jacob Gerritson, Kankakee, Ill., assignor, by mesne assignments to Paramount Textile Company, Chicago, Ill., a corporation of Illinois.

A holding-device for hosiery-drying and shaping forms including a relatively thin backing-member of heat non-conducting material provided with slits, a fabric hosiery-engaging element having its central portion overlying the section between the slits of the backing-member and its edge-portions underlying the sections thereof beyond the slits, and a fabric member-covering of heat-conducting



material overlying said edge-portions; the backing-member constituting an encompassing frame for the hosiery-engaging element to protect its edges; and the hosiery-engaging element and member-covering, together, presenting a fabric facing for the backing-member approximately co-extensive with the surface dimensions thereof.

AMERICAN PRODUCTION OF POPULAR DEVELOPED COLOR ANNOUNCED BY NEWPORT

The Newport Chemical Works, Inc., has announced the production of a dyestuff identical with the one listed under Schultz 326. This color is probably most widely known as Benzo Violet O (Bayer) and Oxamine Violet (Badische).

The Newport product, which equals the prewar types in every way, will be marketed commercially under the name of Newport Diazo Fast Blue O.

The color yields a violet when dyed direct on cotton that is not sensitive to either acids or alkalies and has fair fastness to washing and light. By diazotizing and developing with Beta Naphthol a dark Indigo Blue is produced that is extremely fast to washing. Other developers may be used with varying results, but that with Beta Naphthol is the one of the greatest interest.

PRICE ADVANCE IN BLEACH POWDER

One of the leading manufacturers announces a further advance in its prices of Bleaching Powder and Liquid Chlorine, effective March 15, 1924, to apply on all business for future delivery taken after that date as follows:

Bleaching Powder for spot sales and contracts for future delivery in carloads, f. o. b. Niagara Falls:

$1.90 per 100 pounds in standard (700-lb.) drums;

$2.15 per 100 pounds in small (300 and 400-lb) drums.

Shipments in less than carloads, spot or contract, fifteen cents (15c.) per 100 pounds above these prices. Ex-warehouse prices of Bleaching Powder, New York and Philadelphia, are advanced also.

Liquid Chlorine for spot sales and contracts for future delivery in tank car lots and in cylinders, f. o. b. Niagara Falls:

$4.50 per 100 pounds in tank cars (single or multi-units).

$5.50 per 100 pounds in cylinders, in carload lots.

$6.50 per 100 pounds in cylinders, for sales of more than one ton.

$7.50 per 100 pounds in cylinders, for sales of one ton and less.

LAUNDRY RESEARCH AT MELLON INSTITUTE

George H. Johnson (B. T. C., Lowell Textile School, 1920) has been appointed senior incumbent of the Multiple Industrial Fellowship sustained in Mellon Institute of Industrial Research of the University of Pittsburgh by the Laundryowners' National Association.

Mr. Johnson, who is a specialist in textile chemistry and dyeing, will have supervisory charge of the investigations on laundering in the Institute and will serve ex-officio as director of the recently organized Department of Research of the Laundryowners' National Association. His principal assistant will be Miss Mary M. Danley, an Industrial Fellow of Mellon Institute, and his advisers will be Dr. W. F. Faragher, assistant director of Mellon Institute, and Dr. A. F. Shupp, resident manager of the American Institute Laundry, Joliet, Ill.

The Lammert & Mann Company of Chicago have issued an attractive folder describing and illustrating their line of dry vacuum and pressure pumps. Descriptions of seven different types of pumps are given, with specifications and photographs of each model.

WASH TEST LABORATORY OPENED BY SOAP MANUFACTURER AS PUBLIC SERVICE

A wash test laboratory to prove the fastness of dyes and the washability of textiles, including knit goods and other materials has been established by Procter & Gamble, soap makers, of Ivorydale, Ohio, as a service to manufacturers of dyed fabrics.

The service is offered gratuitously by the Procter & Gamble Company to all manufacturers who wish to assure themeslves that the products which they sell to the consumer are color fast, and to establish the best and safest methods of washing each particular fabric.

The announcement was made by H. S. Brutton of that company who gave an example of the type of work the new service would perform.

"The Moorhead Knitting Company of Harrisburg, Pa., the makers of Moniso socks, made a sock about whose color-fast properties they were in doubt and sent it to the Procter & Gamble Company for test in their laboratory. The socks were found unwashable even with the purest soap. The Moorhead Knitting Company sent another lot after a few months' experimenting with better dyes and better processes. This was again found unsatisfactory and the company therefore decided not to market the product.

"The efforts of this company are indicative of a nearly universal desire on the part of manufacturers to sell to the consumer only such materials as are honestly and perfectly what they represent. The Procter & Gamble Company inaugurated this service because it is eager to do all that it can to aid such socially constructed policies."

An excellent 60-page technical brochure, entitled "Power Plant Lubrication," is ready for distribution to those interested by the Tide Water Oil Sales Corporation. It is an exceptionally attractive looking book, with heavy card covers printed in three colors. Its text, supplemented with over forty illustrations in line and color, shows evidence of skillful preparation and covers quite completely the lubrication of industrial machinery. A brief but interesting conclusion describes the Tide Water Oil Company, its scope, facilities, products and service.

The Aniline Color & Chemical Company, Inc., 162 West Kinzie Street, Chicago, is Western representative for the Garfield Aniline Works, Inc., the New England Aniline Works, Inc., and Jacques Wolf & Co. J. B. Jones and Philip Bower, both formerly connected with the Dyes Distributing Corporation, Chicago, are general manager and chief chemist, respectively, of the Aniline Color & Chemical Company.

AVAILABLE TRADE LISTS DISTRIBUTED BY THE DEPARTMENT OF COMMERCE

The Commercial Intelligence Division, Bureau of Foreign and Domestic Commerce, has recently compiled the following trade lists, mimeograph copies of which may be had from the bureau or any of its district or co-operative offices by referring to title and file number:

MEDICINAL AND PHARMACEUTICAL PREPARATIONS

Importers and Dealers—Sweden, EUR—12041; Belgium, EUR—1036; Spain, EUR—11054; Italy, EUR—6033; Switzerland, EUR—13028; Poland, RD—65076; Greece, NE—5030; Cuba, LA—31041-A.
Manufacturers—Chile, LA—13049.

DRUGS AND CHEMICALS

Importers and Dealers—Peru, LA—20007-A; Norway, EUR—9004-B; Turkey, NE—6015.
Manufacturers—Czecho-Slovakia, EUR—16010-A.

INDUSTRIAL CHEMICALS

Importers and Dealers—Italy, EUR—6034; Spain, EUR—11018-A; Belgium, EUR—1037; Poland, RD—65074; Sweden, EUR—12042; Switzerland, EUR—13027; Chile, LA—13047.

DYESTUFFS, DYES AND COLORS

Importers and Dealers—Spain, EUR—11053.
Manufacturers, Importers and Dealers—Italy, EUR—6006-A.

HOSPITALS

Panama, LA—28021; Honduras, LA—25018.

Much detail is given as to the specific lines handled and the sales facilities of each concern. Complete detail is on file and available to American concerns on the "Exporters Index" as confidential information respecting the foreign concerns listed.

Lists previously announced and available through the bureau or its district and co-operative offices are:

MEDICINAL AND PHARMACEUTICAL PREPARATIONS

Argentina, LA—10105; Brazil, LA—12032; China, FE—13015-C; France, EUR—3035-A; Netherlands, EUR—8001-A; Australia, FE—23053; Chile, LA—13043; England, BE—2041; Mexico, LA—30019-B.

DRUGS AND CHEMICALS

British East Africa, BE—6043; Australia, FE—23023-B; British Malaysia, FE—18019; Costa Rica, LA—23003-A; Denmark, EUR—2005-A; Dutch East Indies, FE—19023-A; Guiana, LA—16006; India, FE—21010-B; Jamaica, LA—34036; Newfoundland, BE—1039; Paraguay, LA—19003-A; Siam, FE—17008-C; Trinidad, LA—34004-A; South Africa, BE—6018-A; Bermuda, LA—34046; Canary Islands, EUR—11045; D. West Indies, LA—36002-B; Dominican Republic, LA—32005-A; Ecuador, LA—15010; Honduras, LA—25007-A; Indo-China, FE—16008; Japan, FE—11010-B; Panama, LA—25012-C; Porto Rico, LA—S-9; Syria, NE—9012; Uruguay, LA—21021; Jugoslavia, NE—3005-A.

INDUSTRIAL CHEMICALS

Brazil, LA—12085; Netherlands, EUR—8013.

PHARMACEUTICAL PRODUCTS

Manufacturers—Argentina, LA—1007-A.

GRASSELLI TO SELL ALIZARINE RED

The Grasselli Chemical Company has been named as sole selling agent outside of New England for the new Alizarine Red Powder recently placed upon the market by the Beaver Chemical Corporation. This product is identical in its shade and properties with the well-known imported brands of Alizarine Red W, WB and IWS.

SALES MANAGER—EXECUTIVE

Thirty years' varied experience in the dyestuff business, associated with the most representative importing and domestic houses, holding positions of wide responsibility. Thorough acquaintance with all types of dyestuffs, and requirements of prominent consumers. Unqualified credentials. Presently available. All communications confidential. Address Box 242, American Dyestuff Reporter.

LABORATORY CHEMIST

Young man with eight years' experience in dyestuff laboratory work seeks new position. Graduate of Pratt Institute. Thoroughly competent to take charge of sample testing and matching, and all routine laboratory work. Address Box 247, American Dyestuff Reporter.

WANTED

Dyestuff Laboratory Supervisor. Must be familiar with application of dyes on textiles. Excellent opportunity for right man. Give full particulars regarding previous experience, etc. Box 248, American Dyestuff Reporter.

FOR SALE

Small lots of Algol Yellow, Indanthrene Blue and Algol Red. Closing out. No reasonable offer refused. Address Box 249, American Dyestuff Reporter.

MATHIESON Chemicals

An Epoch in the History of Liquid Chlorine

THE recent decision of the Interstate Commerce Commission, giving tank car rates and privileges to the Mathieson Multi-Unit Chlorine Gas Tank Car, marks an epoch in the history of Liquid Chlorine.

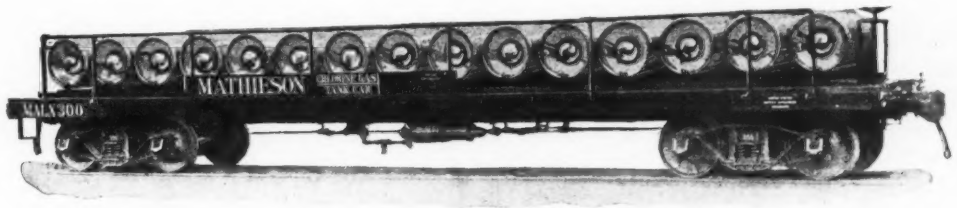
The Multi-Unit Car, designed by our engineers, carries fifteen one-ton units of Liquid Chlorine instead of a single fifteen-ton tank. When we placed this special car in service over two years ago, the railroad companies refused to allow us tank car rates. We appealed to the Interstate Commerce Commission for removal of this discrimination and continued making shipments in the Multi-Unit Car.

During the past two years we have paid out over two hundred thousand dollars in excess freight charges in order that the chlorine-consuming industries might benefit by the continued service of a tank car ideally constructed for the safe, economical and convenient use of Liquid Chlorine.

The present decision of the Commission upholds our faith in the Multi-Unit "Safety First" principle and awards us full reparations with interest.

Thoughtful consumers will recognize in this case a further proof of the leadership we have assumed in the chlorine industry.

You are cordially invited to visit us in our Booth, No. 252, at the Knitting Arts Exhibition, Philadelphia, Pa., April 7th-11th, 1924.



The **MATHIESON ALKALI WORKS** *Inc.*
25 WEST 43rd STREET NEW YORK CITY

PHILADELPHIA
PROVIDENCE

CHICAGO
CHARLOTTE

EAGLE THISTLE PRODUCTS

Deal Direct with the Manufacturer

Bicarbonate of Soda
Liquid Chlorine-Caustic Soda
Sesquicarbonate of Soda
Bleaching Powder-Soda Ash

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INTERNATIONAL SALT

THE BRIDGE TO SATISFACTION

Why does the International Salt Company work unceasingly to give satisfaction in service as well as in product?

Because it realizes that prompt deliveries of pure salt in any required quantity is necessary to the effectiveness of industrial processes.

When you order International Salt we meet the implied obligation of service.

INTERNATIONAL SALT CO., INC.
Scranton, Pennsylvania
New York Buffalo Pittsburgh

Established 1895

BOSSON & LANE

Manufacturers of

The Original

BLEACHING OIL

for boiling out Cotton, to produce a foundation for a Pure White

High Grade Sulphonated and Saponified

CASTOR OIL PRODUCTS

Para Soap Oil

Solvents and Assistants for cleaning all Textiles

B & L Bleachers' Bluings and Tints

Works and Office, ATLANTIC, MASS.

The Delivery Bugaboo Banished

DELIVERY on dyed yarns should no longer be a bugaboo to textile mills making colored goods.

In the days when warp dyeing could not be avoided delivery of dyed yarn was a matter of months. It was necessary to place orders for dyeing far in advance of the time when the popular colors for the coming season could be accurately predicted. If you guessed right you made money, if you guessed wrong you lost.

Of course it was not as bad as it might have been because everybody was in the same fix. Warp dyeing was the only method.

Today however the mill that still uses warp dyeing is at a decided disadvantage as compared with the mill that has its yarn dyed by the modern method, the FRANKLIN PROCESS.

This extremely successful process enables us to make delivery on an average of ten days to two weeks. And when necessary we are prepared to make substantial shipments within 2 or 3 days after receipt of yarn. Customers who keep stocks of gray yarn on hand with us frequently get such quick deliveries.

The yarn is wound from bobbins to Franklin Packages. These packages are dyed in the wound form and after dyeing go directly into the V creel for warping. There is no long chain beaming operation at all. It is absolutely eliminated.

Thus we not only save you time but also money.

And the colors are superior. Applied under pressure, Franklin colors completely penetrate the yarn giving unusually solid and brilliant results.

Prompt delivery, a reduction in manufacturing cost, superior colors,—and prices are no more than those of any other process, sometimes less. It is a money making opportunity which demands your careful investigation.

Why not get the complete story? Write for our color cards as a starter. A letter on your business stationery will bring them, also a Franklin representative, if you so specify.

FRANKLIN PROCESS COMPANY

Yarn Dyers · Yarn Merchants · Mfrs Glazed Yarns · Dyeing Machines

Philadelphia · PROVIDENCE · Manchester, Eng.

New York Office 72 Leonard St.

SOUTHERN FRANKLIN PROCESS COMPANY

Greenville, S. C.

An Offering
To the Textile Industry

"AQUASOL"

THE NEUTRAL SOLUBLE OIL
for
COTTON, SILK AND WOOL
Indispensable in Quality Work

for
Level Dyeing
Mercerizing
Finishing
Scouring

Especially Adapted for Hard Water

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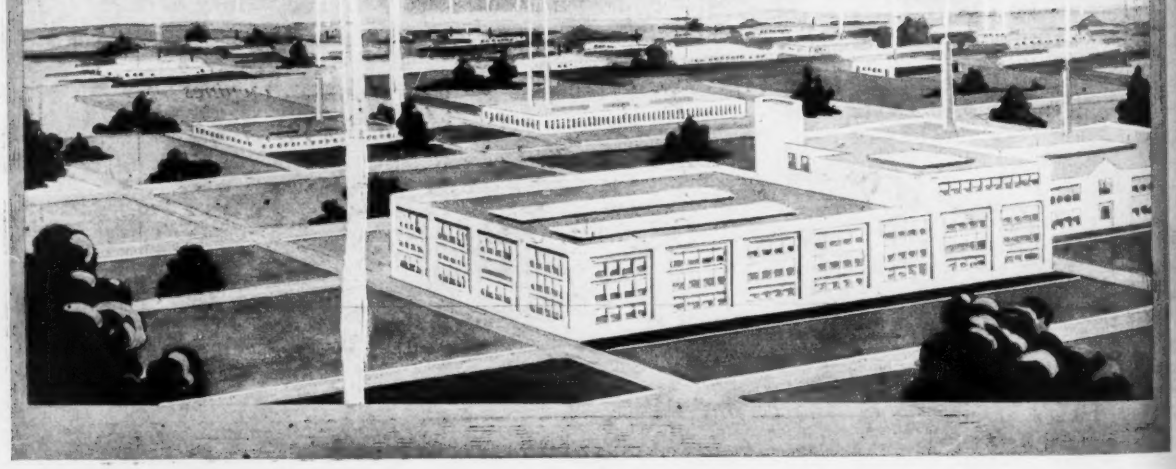
644-52 Greenwich St.
NEW YORK CITY
Branches:
Boston Philadelphia Chicago Providence, R. I. Charlotte, N. C.
Represented in Canada by
A. KLIPSTEIN & CO., Ltd., 12 St. Peter Street, Montreal



TEXTILES PAPER LEATHER

AMERICAN DYESTUFF REPORTER

SAMPLE SWATCH QUARTERLY

APRIL 7, 1924

Selling Agents for
J. R. GEIGY S. A.
Basle, Switzerland

BRANCHES:
Boston Philadelphia
Providence Toronto
Columbus, Ga.

GEIGY COMPANY, Inc.

89-91 BARCLAY STREET
NEW YORK, N. Y.

In Great Britain:
THE GEIGY COLOUR CO., LTD.
35-37 Dickinson Street
Manchester

Branch Works at Clayton

To Dyers of Hosiery and Other Mixed Fabrics:

The steadily increasing demand for hose and other mixed fabrics composed of various combinations of fibres has led us to concentrate the efforts of our laboratory and staff of practical demonstrators on the development of a line of specialties which will adequately meet the many difficulties encountered in attempting to dye a full range of shades on these mixed fabrics with ordinary dyestuffs.

In this effort we have been remarkably successful, and now beg to advise you that we are prepared to furnish a range of colors and dyeing processes which will produce the following results:

Cotton and Silk—Dye cotton and not touch silk; dye silk and leave cotton clean; dye both fibres alike.

Artificial Silk and Cotton—Dye both fibres alike.

Artificial Silk, Real Silk and Cotton—Produce union shades as nearly perfect as they can possibly be produced today.

Wool and Cotton, or Wool and Artificial Silk—Leave either of the two fibres white; dye both fibres alike; produce Heather effects.

If you are experiencing difficulty with work of this class we shall be glad to submit dyeings on your own material to match your shades, or to furnish samples on any of the above-mentioned materials.

Very truly yours,
GEIGY COMPANY, INC.

SEE OUR DYED SAMPLES ON PAGE IX

KLIPSTEIN CHEMICAL *Specialties*

for

TEXTILE PROCESSING

HEREIN is a partial showing of a most extensive group of specialty Compounds and Preparations covering practically every Textile Chemical operation.

These products are the direct outcome of our exhaustive laboratory experimentation, coupled with practical experience in those problems existing throughout the textile industry.

We offer also a most extensive line of

Dyestuffs and Colors

Textile Oils—Gums and Waxes

Chrome Acetate

THIS compound is a mordant adapted for calico printing and also is extensively used for dyeing of Mineral Khaki on cotton.

Nainsook Softener

THIS preparation is especially adapted for pure finishes of the Nainsook checks for summer wear, and any such kindred finishes, where a soft, silky feel is required.

Aquasol

A PRODUCT especially useful in dyehouses where level dyeing and penetration of the dyestuff and lustre are desired.

Softener T

A COMPOUND perfectly adapted for cotton warp sizing. The thorough penetration obtained with this size on the warps reduces to a minimum the flaking or dusting off.

Ammonium Acetate

THIS compound is a mordant adapted as an addition to the dye-bath in the dyeing of woolen goods with Alizarine Colors.

Softener 8 A

A COMPOUND particularly well adapted for the finishing of Ginghams and similar fabrics.

A. KLIPSTEIN & CO.

644-52 Greenwich St.

NEW YORK CITY

Branches:

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PROVIDENCE, R. I. CHARLOTTE, N. C.

Represented in Canada by

A. KLIPSTEIN & CO., LTD., 12 ST. PETER ST.

MONTREAL

AKC

STRADY MASS

Reg. U. S. Pat. Off.

Indanthrene
Thio-Indigo
Helindon
Hydron
Algol

and other vat dyes will be imported by us direct from the manufacturers

Reg. U. S. Pat. Off.

A complete line of

Acid, Basic, Chrome, Sulphur and Direct Colors, Intermediates, Cotton Finishes, Turkey Red Oils, Soluble and Leather Oils

Manufactured by

Consolidated Color & Chemical Co.
Central Dyestuff & Chemical Co.
Williamsburg Chemical Co.

And other American Manufacturers

Special dyestuffs
for
Acetate Silk

H. A. METZ & CO. Inc.

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128 Oliver St., Boston, Mass.
301½ West Trade St., Charlotte, N. C.
449 N. La Salle St., Chicago, Ill.
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STRAIGHT TO THE MARK—

Shade
Strength
Uniformity
Value

Katigen Deep Black GGN Conc.

The Grasselli Chemical Co.

DYESTUFF DEPARTMENT
117 HUDSON STREET NEW YORK

Chicago Philadelphia Providence Charlotte Boston
San Francisco New Orleans

C&C CHEMICALS

"EGALISAL"

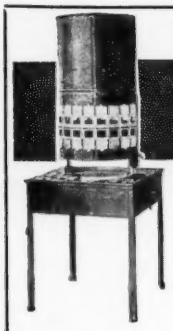
FOR SCOURING AND DYEING OF

RAW WOOL, TOPS, YARNS
AND
WOOLEN and WORSTED
PIECE GOODS

Level Dyeing
Thorough Penetration
Shorter Dyeing Period

COOPER & COOPER, Inc.

23 CLIFF STREET
NEW YORK



Will it Fade? Ask the

FADE-OMETER

Standardized Sunlight

When You Sell a Firm a Second Time

it's pretty likely that you sell on merit alone. It is just old-fashioned merit that has sold two or more Fade-Ometers to each of the following firms:

Ault & Wiborg Co. (3)
Ciba Co. (2)
Courtauld's, Ltd. (3)
E. I. du Pont de Nemours & Co. (5)
Eastman Kodak Co. (2)
Edwards & Deutsch Litho. Co. (2)
Hart, Schaffner & Marx (4)
Kanegafuchi Cotton Spinning Co. (2)
Marshall Field & Co. (2)
National Aniline & Chemical Co. (2)
National Silk Dyeing Co. (5)
Newport Co. (2)
Okura & Co. (2)
Philip Ruxton, Inc. (2)
United Piece Dye Works (3)
United States Government (7)
Wallpaper Mfrs., Ltd. (2)

The reason is obvious: the Fade-Ometer makes money for its users

Atlas Electric Devices Co.

364 W. Superior St. Chicago, Illinois

New York
F. SCHLAYER
25 Howard Street

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A. D. LANG, LTD.
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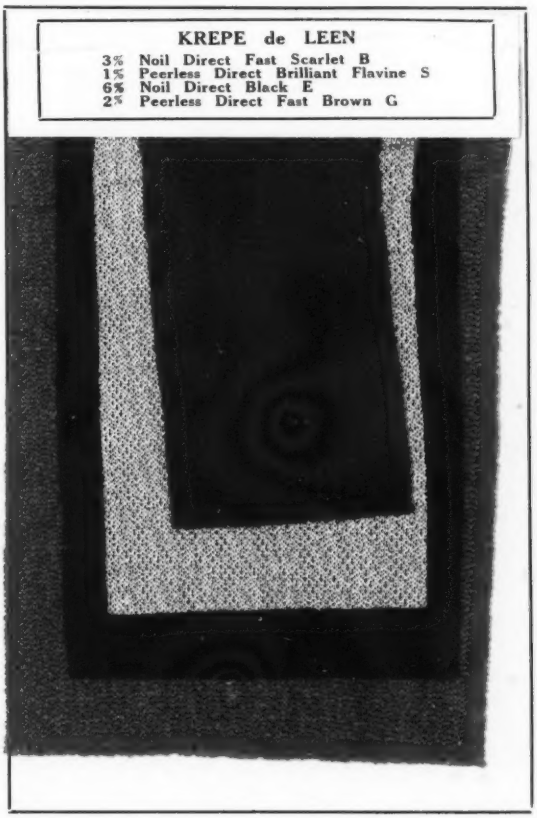
PEERLESS—NOIL

Quality Dyestuffs


KREPE de LEEN
3% Noil Direct Fast Scarlet B
1% Peerless Direct Brilliant Flavine S
6% Noil Direct Black E
2% Peerless Direct Fast Brown G

Superior Products
Maximum Service Efficiency
Constructive Sales Cooperation

Noil Chemical & Color Works, Inc.
152 W. 108th St., New York, N. Y.

Peerless Color Co., Inc.
Plainfield, New Jersey

PROPERTIES

NOIL DIRECT FAST SCARLET B

Produces brilliant scarlets similar to Benzopurpurine 4B with the advantage of not being so sensitive to acids. It is level dyeing, has excellent light fastness on silk and wool, is very fast to hot pressing and alkalies, has excellent fastness to washing and milling against animal fibres and discharges clearly. It is recommended for cotton, wool, silk, half-silk (dyes silk slightly deeper), artificial silk, half-wool, and calico printing.

PEERLESS DIRECT BRILLIANT FLAVINE S

Is a self color, and produces extremely bright green shades of yellow. It is level dyeing, suitable for color discharge, very fast to chlorine, hydrosulphite and hot pressing, and produces brilliant greens in combination with bright blues. It is recommended for cotton, half-wool, half-silk and artificial silk.

NOIL DIRECT BLACK E

Produces full, bloomy green shades of black with a logwood cast. When aftertreated with formaldehyde it possesses excellent fastness to washing and light. It discharges white and is especially suited for silk discharge. It is recommended for cotton, unions (dyes all fibres the same shade), silk, half-silk, artificial silk and leather.

PEERLESS DIRECT FAST BROWN G

Is a self color, producing bright golden shades of brown. It is level dyeing, discharges readily, has excellent fastness to light, acids and alkalies, which fastness is improved by aftertreatment with chrome or blue stone. It is recommended alone and in combination with *Noil Direct Brown M* and *Noil Direct Brown B* for cotton, wool, half-wool, silk, half-silk and artificial silk.

Accurate Standardization
Immediate Deliveries
Uniformity

Stocks are carried by responsible distributors in all textile centres.

Inquiries will receive prompt attention.

Arthur L. Benkert
General Sales Manager
140 West 108th St., New York City

DYELENE PRODUCTS

Dyelene Colors
for Wool and Silk

Standards of Uniformity and Quality

CHROME RED
PONCEAU 3 RB
CLOTH RED B & G
AZO ACID VIOLET
AZO YELLOW
FAST ACID YELLOW G
NAPHTHOL GREEN B
CHROMATE BROWN EBN

DYE PRODUCTS & CHEMICAL CO.
Incorporated
Works at NEWARK, N.J.
200 Fifth Ave. NEW YORK CITY

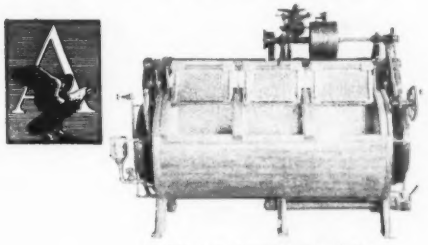
Rotary Dyeing Machines for Hosiery

The ideal machine for light shade dyeing. "Solid head" design; most durably built, with American Syphon dyestuff ejector to assist in even distribution of color. Baffle plates insure maximum penetration. Cylinder hand-finished for silk. Furnished in all standard sizes. Have us send you details

The American Laundry Machinery Co.
Specialty Dept. B Cincinnati, Ohio

The Canadian Laundry Machinery Company, Ltd.
Toronto, Canada

British-American Laundry Machinery Co., Ltd.
36-38 Victoria St., London, S.W.-1, England



42x84" American Monel Metal Rotary Dyeing Machine Belt Drive

THE DYER,

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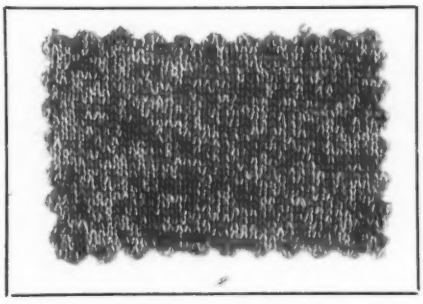
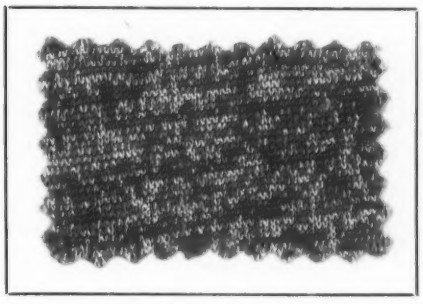


ERIO ORANGE R



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See reverse page for description of some further Geigy specialties

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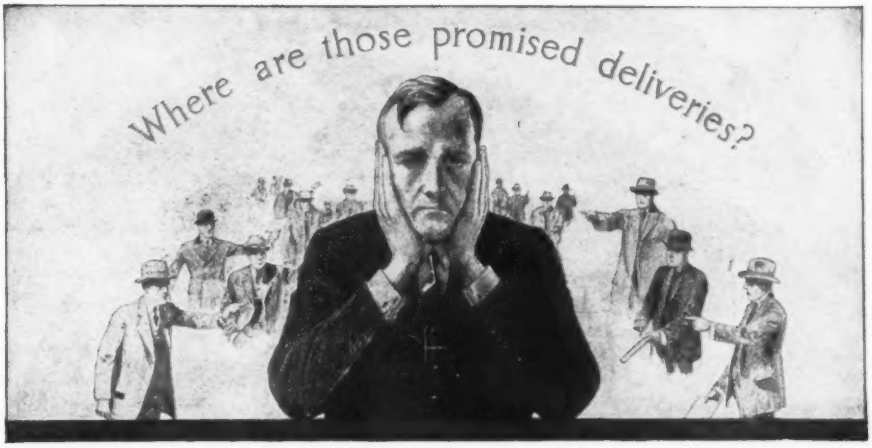
Further information regarding the use of Polar Colors for hosiery dyeing will be found in an article entitled "Artificial Silk and Wool Hosiery" by Louis G. Hayes, published originally in Color Trade Journal and reprinted on page 213 of this issue of the American Dyestuff Reporter Sample Swatch Quarterly.

GEIGY COMPANY, INC.



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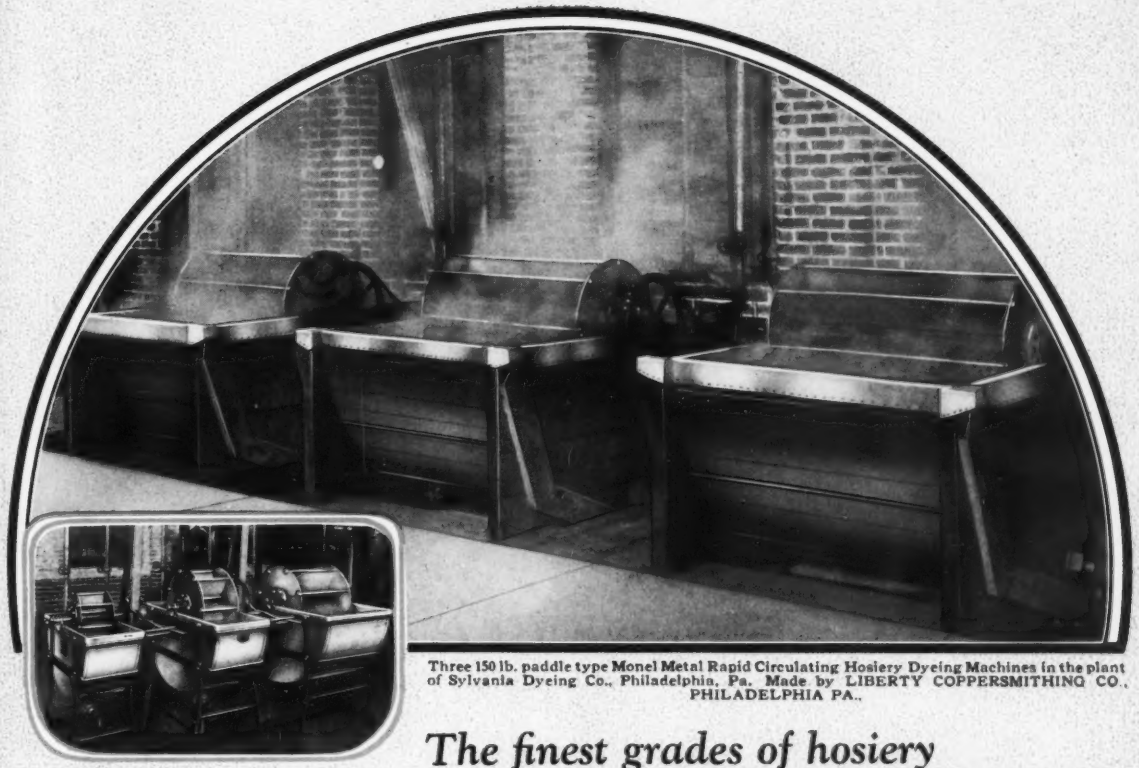

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NEW YORK, APRIL 7, 1924

Simplification in Dyehouse Practice Through More Rigid Control of All Elements

Layout of the Dyehouse—Routing Stock—Auxiliary Machinery and Control Devices—Handling the Dye Materials—System of Keeping Stands

By HIBBARD S. BUSBY

IT may be argued that the employment of intricate methods of standardization in the conduct of dyehouses and the dyeing process merely adds further trouble to an already difficult art. In view of the complications already existent in the dyeing process, it is a matter of observation and experience that no method which fixes constants to which the work can be aligned and generally stabilizes method either increases the degree and number of the present complications or acts other than to set up guide-posts of sure and sound reference in all stages of the practice of the art.

Highly technical standardization of process is, in fact, the surest method afforded to date, for its improvement, stabilization and simplification.

Layout

Ultimately, a very large proportion of the success of this work must be dependent upon the degree of skill in attention to its principles and details exercised by the dyehouse planning department. Upon the extent of their knowledge of processes and efforts toward the achievement of co-ordination of the work in the various units lies the proper basis of successful layout of schedules and daily functioning.

A great deal of attention to the problem of routing should be given by the engineering force when the machinery and equipment plans for original or revised layout are made up. It is not enough to group the machines and barks into such general divisions as rotaries, tubs, and jiggers or cotton, silk, etc.

Process classes are a far more important line of demarcation than fiber and type of machine. Of course, the requirement of separate equipment for such processes as iron blacks, bulk stock wool, etc., is well recognized, but it is advisable to carry the analysis even farther in order to permit of the employment of attachments advantageous to the handling of certain specialized processes. To that end the division of machinery and tubs into groups should be planned as nearly as possible on the basis of such classifications as *developed dyeing, extra fast, resist, sulphurs,* etc. Obviously, if this is possible consistently over the complete equipment an immediate saving in labor and time will be effected as against hurried preparatory operations on the barks.

Certain equipment, like skein washers, extractors, etc., is in sufficient demand throughout the work to call for placement that not only makes them actually available to the various classes of work but is, as well, virtually central in placement to the space available for movement of materials to and from the various machines.

Too little of the lesson of sequential placement of machinery (in terms of operations) has been applied to dyehouses. In preparation and in finishing departments, and in almost all other textile operations, this matter has been studied, profitably, from the viewpoint of both labor cost and facility of handling rush work. In the dyehouse alone it seems to have had little recognition. Due, possibly, to too strict adherence to the construction outlines of dyehouse equipment, certain very easily built supplementary construction has not been provided. Upon this probably depends, to a great extent, a means to tie one machine up to its neighbor (in operation sequence). Especially where wood construction enters largely into the dyeing equipment there is no reason, except lack of understanding of the problem, to adhere so closely to prescribed shape in these matters as is usually done. A great many mills make entire, or replace, parts of their equipment in their own shops; they can, therefore, modify the machines to suit the needs of the problem of making each a part of a connected plan, continuous from entry of stock to finished process.

Routing

It is assumed that a dyehouse has progressed to the stage where some consistent effort is made to route the

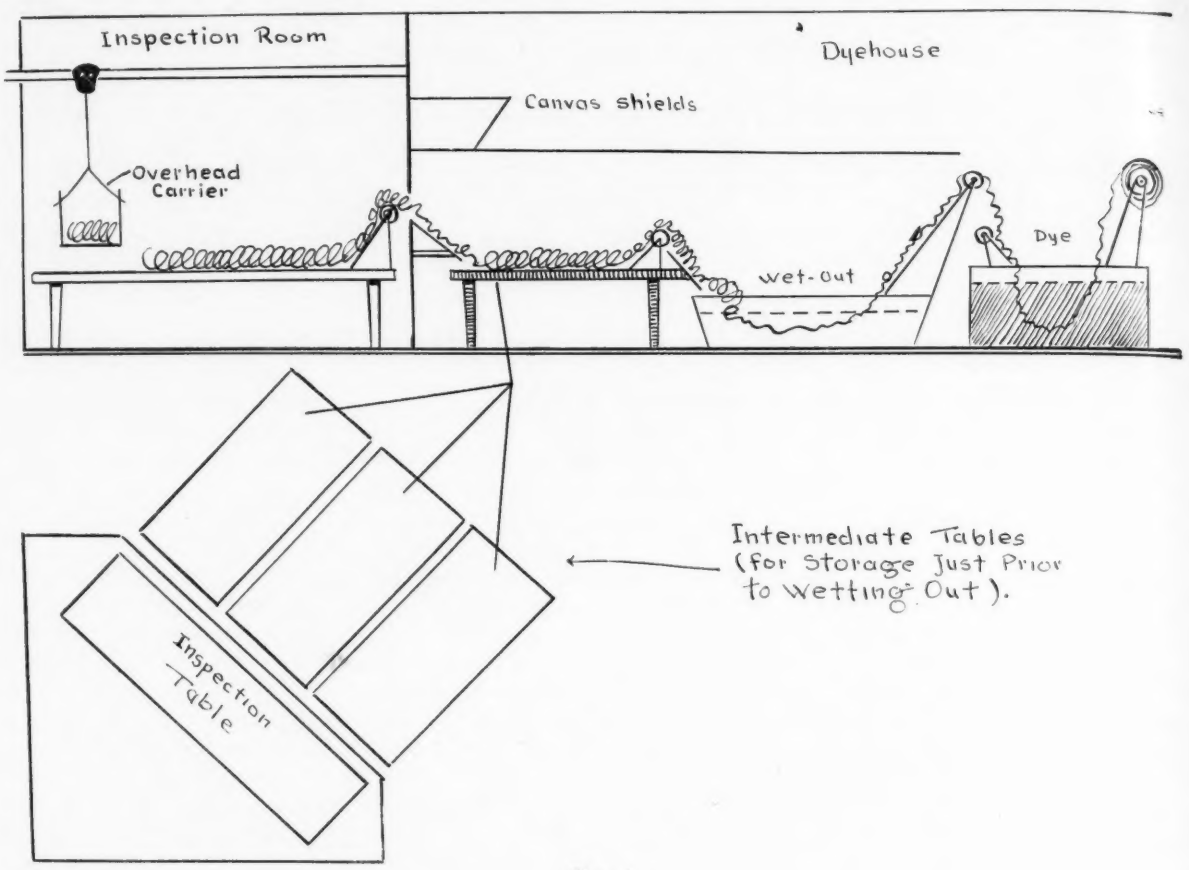

FIG. 1

work from operation to operation by a system of mill or dyeing orders. According as it is the plan of the particular organization, either a route-card or planning-board system is effective. The chief thing is to assure that these are handled properly and that the sequence of operation is the best possible under the conditions encountered.

It is not apparent how even skillful clerical personnel are best equipped to handle this matter—rather would it be better to take a man trained in dyehouse practice (and exigencies) for this sort of work, teaching him the principles of estimating, layout and routing.

As one instance of the sort of difficulty encountered, the various types of dyeing, calling as they do for more or less rigidity in attention to details of follow-through on the part of the dyer, may become a serious cause of discrepancy between time allowed and actually consumed and consequent friction in schedules, unless allowance is made therefor based upon an understanding of the practical difficulties involved.

It is of considerable importance also to group the various items of the day's work into such general color groups as to insure that each color shall be combined with its fellows within a consistent dyeing group. In the same sense, heavier colors of the same general class should follow lighter and more vivid ones where possible. This frequently saves much machine-cleaning time.

The estimated day's work is a very vital matter for all concerned, from machine-hand to owner. No amount of mathematical calculation will result in 100 per cent outcome that balances the estimate (over every day's production). However, if to experience records of time required to perform work based upon exactly calculated formulas are added standard conditions surrounding processes and continually increasing experience in the *possible happenings* involved in the various classes of work, increased benefits are sure to result that are advantageous and profitable for everybody in a good organization, from the owner down to the machine-hand.

STOCK

The material which is to be treated in process is one of the major costly elements around which price reduction and improvement effort are constantly being carried on. It is only reasonable, therefore, to have the major efforts possible centered upon its treatment and protection against damage. From the time of its procurement from warehouse, gray storage or preparation department no unnecessary exposure to the risks of the dyehouse should be tolerated.

It should be brought into the dyehouse in covered bins or carriers and remain in them, in so far as possible, until

ready for use. When an opening or inspection stage has to precede wetting-out, this should be done in a section completely filtered (by means of cloths or fine-screen mesh) from the process rooms. Flying particles of dyestuff, oily and dirty drippings from the ceilings and walls, sudden blasts of steam and jets of water, and slops of soap or water can be best guarded against by the closed-carrier method of handling described.

In order to maintain the highest degree of quality in the finished result, all speed should be applied to bringing the fabric out of the main process room immediately following its last treatment. It is just as bad for *dyed* materials to suffer the above-mentioned exposures as it is for raw stock, and the minimum of time spent in the exposed region is the best protection against such an eventuality. In the same sense, open spaces which material must traverse in process of transfer from one operation to another should be protected from overhead drip and side blasts from adjacent processes.

The same thing is true of goods waiting additional treatment prior to finishing. In view of these facts, methods which attempt to save time or increase daily output through hanging up lots midway in process schedule, over noon or over night, should first be given serious consideration from the viewpoint of whether or not the condition of the dyehouse is such as to offer any risk to them during such periods.

Auxiliary Machinery and Control Devices

Much of the trouble and annoyance of awkward conditions under which work is performed may be eliminated by the proper employment and disposition of the auxiliaries of process machinery. They are either a constant nuisance or a never-ending source of helpfulness when called upon to stand up under unusual requirements of service. (Here again the construction engineer may well take a hint from the man familiar with the process.)

Piping that is to handle the chief supplies, steam, water, soap and liquors, should be arranged with control facilities at central points near the dye machines to be served. Sizes for each type of service pipe should be the same throughout the dyehouse, the manner of leading down from mains peculiar to each service, and mains, valves and outlets should bear a distinctive mark and color designating what the service is. This schedule of markings should be appropriately placarded at each central point of outlet.

It would seem almost needless, in this day of improved facilities and economy through investment in low operating cost machinery, to specify that all possible labor should be done electrically rather than by hand.

The most up-to-date dyehouses have individually driven machines, and power draft and pressure, yet they frequently carry an unnecessary labor charge for movement of materials. It is not uncommon to see one truckman for every six or eight machine operators, or else the machine operator giving a part of his time to such work. At the cost of overhead trolley track and other carrier systems to-day adequate provision can be made for all movement of goods (of the class of cartage) into, throughout and out of the region of operation at an investment rate comparing favorably with labor costs. The best systems are semi-automatic in operation, requiring no other services than ordinary maintenance and the action of the dyeing machine tender to start them on their way.

The greater the degree of exact control of operations through the use of recording and control instruments the more is dyeing brought out of the class of being a "black art." A corollary to that is that to the limit possible the records of these machines, other than absolutely necessary to the machine operator, should register (through remote-control methods) in the planning and administration offices. With these data thus instantly available, the chief planner has constantly a means to check up on the progress of his schedule. It is better to have job terminations registered in this way than through time-cards, as not only is the attention of the operator fixed on his task and non-subject to the diverting effect of "bookkeeping" but, of utmost importance, the planning and routing staff is enabled to keep in close touch with all fluctuations in time required by the various jobs and to plan its advance schedules accordingly. This is particularly apparent where the advent of an emergency order requires instant survey of the program resources available. Besides, when all is said, the place for a dyer and his machine men is in the dyehouse, and for office men it is in the office.

Simplification that is a resultant of surrounding effort with standardized control is effected par excellence through use of the proper control instruments. There is, first of all, the rigid recording and control of time of operations, temperature, volume of bath, pressure, number of revolutions of the material in the liquor, etc.; but of greater importance is the uniformity in product obtained through machine watchfulness rather than dependence

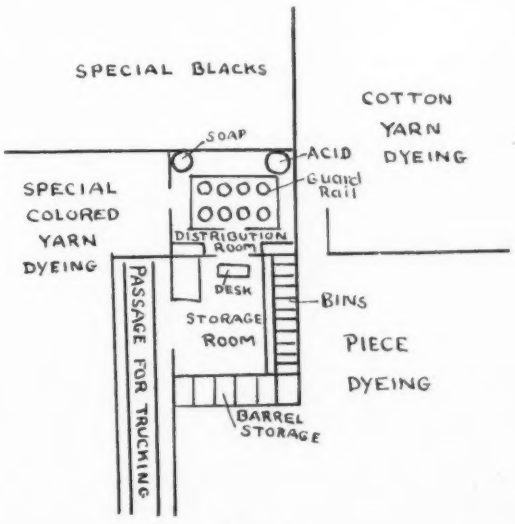

Fig. 2

upon human follow-up. The burden is placed upon skilled machines rather than upon unskilled men.

Handling the Dye Materials

Trade literature carries the advertising of many devices for the transportation of the major chemicals used in the dyehouse and, in a general way, gives some very good suggestions for the care and handling of them. The efficient disposition of these chemicals within the dyehouse proper is, however, a rather neglected factor. With the non-corrosive containers and pumps available to-day, it is very easy to bury the acids so that their fumes will not penetrate to the dyehouse proper nor otherwise escape, and to pump them up into small storage containers, from which they can be served to the various barks whose lots demand them. Where there are barks used frequently for large-size lots that require acid in pail quantities, it is well to provide the machines or vats which run these lots with a small pipe to carry the acid direct. Safety, economy and the bad effects liable to result from an open pail of acid set upon the floor are eliminated by this means. It further eliminates the ticklish process of pouring into the bark from a pail and the frequent inaccuracies in measurement resulting from a man's dislike to return for replenishment of a partially spilled pail. Bulk chemicals (solids) can be delivered by a carrier system.

Where a standard type of liquid soap is in constant use, there is every reason for its centralization in a storage tank placed sufficiently high up to effect delivery to the barks through pipes by gravity. The gravity method removes the difficulty frequently encountered of alternate flows of varying degrees of thickness of soap liquor.

If the right precautions are taken at the source—i. e., the exit of the soap from the tank—uniform deliveries of quality and properties are easily effected at the barks. Valves for this type of delivery *must* be at the tank, lest backing up in the pipe change the consistency of the mixture delivered. The awkwardness of this feature can be overcome, however, through employment of extension rods on the valve-operating wheels.

Chemicals, soaps, general supplies, dye stocks and dye stands should be contained in and issued from one central storage room, completely shut off by adequate wall and doors from the process rooms. It should, however, be contiguous to all the process rooms. This room should be in two principal parts, a storage or stock room and an issue room.

The stock room should be arranged in approved stock-keeping practice, with facilities for storage of dry chemicals and containers of dry and paste dyestuffs, also with racks for the support of barrels and carboys of acids, etc., in readiness for withdrawal in quantities demanded. This room should provide space for records and data of invoices of inward shipments and current unfilled orders, as well as specifications for the sampling necessary to be furnished the laboratory for comparison with required standards. The desk of the dyehouse stock clerk should be located here, as well as a central station of the dyehouse carrier system.

The issue room should contain the soap tanks, underground acid storage and dye stands.

The system of keeping stands described below is based on the assumption of a *centralized method of laboratory control of dyeing* necessitating that each stand be kept at fixed constants of strength and other tinctorial properties.

Dyestuffs issued direct to job, without going through the stage of boiling up into a stand barrel, are mixed here (under a standard method of dissolving all alike under the same conditions) and, whether powder or paste, are prepared in this room for immediate introduction into the bark (Fig. III). This checks requirement against the formula route with the lot—the only basis upon which any material can be issued—and is a further provision against variation from standard practice in succeeding lots which are dyed. It is, moreover, a basis of exactly recording dye expenditure for the cost department. Paste dyes issued are introduced into the bath at standard rates per volume of bath, providing for uniformity of solution and eliminating the danger of blotching from improper dissolving.

The ancient practice of keeping dye stands is a blight on hopes of progress in the dyeing art. How it could reasonably be supposed that a dyer could be anything but a magician and approximation artist with the facilities thus furnished him is beyond imagination. Inquiry as to the method pursued in maintaining these stands has disclosed some interesting things. Sometimes all the stands are made by boiling up a fixed quantity of dye per barrel, regardless of what the dye is or of changing concentrations in successive shipments. Others boil up varying quantities for each dyestuff and still others "boil up enough to bring up the strength of the mixture to what is required!" Little or no attempt is made to fix a definite tinctorial standard and to *control the mixture in the barrel to that standard throughout its existence.*

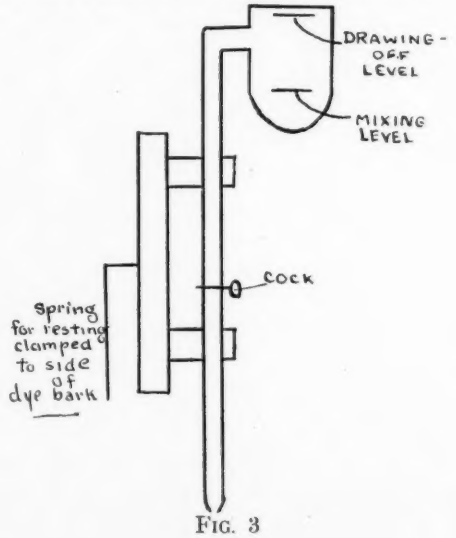

Fig. 3

Another feature of very great importance is the exact amount of stand solution issued in accordance with formula demand. This can be regulated exactly by the means

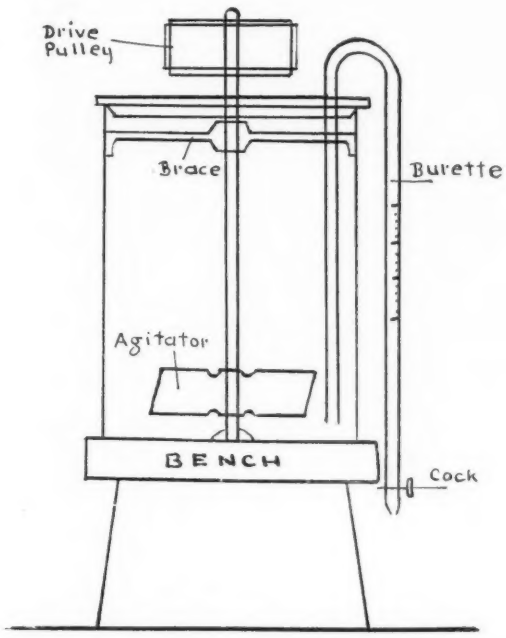

FIG. 4

described in the illustration (Fig. IV). The burette withdrawal of barrel contents assures an accuracy of delivery outstanding and eliminating the persistently troublesome inaccuracies of dyehouse measures, no matter how well calibrated and cared for they may be.

The tinctorial standards of these stands, being the basis of formulas issued with the lot, are fixed by the laboratory from tinctorial data determined there and are checked by rigid periodical inspections to preserve their status.

A properly determined standard will not deteriorate greatly under reasonable life, but to assure their constancy agitators are introduced into each barrel and thorough mixing is performed throughout each day's use. This further facilitates complete and thorough means of mixing the original contents of the barrel when it is first made up.

Incidentally, the accuracy to which dye stand liquor must be apportioned to lots is not as great as some discussions of this subject might lead one to believe. The burettes need not be calibrated nearer than 1 c.c. and the liquor will seldom be used in that volume if stands are made up in proper strengths. Pails or carriers on the conveyor may be used under this system; no large variety of beaker measures of dyestuff need be carried in stock to assure accurate measurement of the dye liquors. Indeed, this method provides the means for a very desirable feature in dyeing, especially dyeing to standard formula; viz., that the various proportions can be measured out and mixed in one pail at the start, then as much of this *mixture* as is found to be desirable introduced into the dye bark at the various stages of the operation found to be suitable to the nature and conditions of the work.

Chemistry—An Aid to the Knitter

Knitter Has Same Problems as Solved by Chemists in Other Lines—Addition to Overhead Expense Overbalanced by Savings—Troubles Stopped Near the Source—Research to Keep Ahead of the Times—A Laboratory Broadens the Entire Plant Viewpoint

THE purpose of a knitting mill is to manufacture hosiery, sweaters, underwear, and so on, to an ever-growing ad infinitum, and to produce a profit in the face of another infinity of doubts and difficulties. We of the chemical cult feel that chemistry applied with the common sense that is often called science, together with the ordinary everyday sort of common sense, can be of surprising assistance in attaining both of these worthy ends.

The first and perhaps most convincing evidence of the value of chemical service is experience in the many lines of textiles where chemists have already found responsible prmanent places. Actually the uses for a chemist in the knitting industry are precisely like those in any other branch of textiles. There are essentially the same problems on wool before and after knitting as before and after weaving; and the same observation applies to cotton, wool silk or "art" silk. Each textile plant of whatever nature has its own special problems, but they all depend upon the general properties of the textile fibers and of the chemicals and dyes with which they come in contact.

While knitting has its particular requirements in softness and elasticity of yarns, in uniform quality of artificial silk or levelness of mercerizing in cotton, or in the necessity for dyes to color two or more kinds of fiber in the same stocking to the same depth and tone, the problems are not at all unique, but have already been met in some form and solved by chemists.

LABORATORY NOT OVERHEAD

The first reaction to the thought of adding a chemist and laboratory, or of increasing existing facilities,

will be "more overhead," and to be sure it *will* be at first. Since the only justification for adding or enlarging such service will be its influence on profits, the results must be evaluated in some way, then when the savings overbalance the expense it is no longer overhead, no matter how it may be carried on the books, for the laboratory will then have become a producer.

Unfortunately, there is no rule defining the length of time it takes for a laboratory to make good, for the opportunity for direct savings is as varied as the knitter's product.

We can, however, give a little idea of what may be expected, and for convenience we shall consider direct savings and indirect savings, then those less definite but favorable influences which follow from the presence of a laboratory and from the inquiring attitude and unbiased judgment of a qualified laboratory director.

The first and most obvious direct saving will come from a study of supplies, including their chemical analysis. The experienced chemist has a point of view and he has tools that are not shared by the purchasing agent or the users of the materials. His reports are necessarily based on the facts of systematic testing and of careful analysis. Sensible specifications will then assure the purchaser of the best on the market in quality and value. Such work has yielded large returns for many mills when applied to yarns and fibers, coal, oils, soaps, heavy chemicals and dyes. Sometimes it is just a case of arousing the right sort of competition, while at other times substitution of one thing for another will effect a large cut in cost, such items running into thousands of dollars in large corporations.

The intelligent testing of supplies, however, depends on their use and necessitates a study of mill processes, but such investigation should go much farther than the mere choice of materials, for almost anything can be improved. Efficiency, in spite of years of overwork, is still a good husky English word. It means saving space, materials, labor, etc., any or all of which can result from the application of science to industry. Efficiency men from outside the organization have their uses, and the outside point of view is often valuable. However, the inside man, in this case the chemist, takes a more vital interest and can accomplish more in the end because his future job depends more directly on his results and on taking his employer's interest very seriously to heart.

Indirect Savings

Most important of the indirect economies are those that tend to keep the knitter out of trouble. Simple routine control tests are being more and more widely adopted; for instance, reliable chemical tests for acids, alkalies and bleach liquors in place of the unreliable Twaddle, and systematic tests of yarns and fabrics before and during process to catch immediately any tendency to deteriorate in strength or to depart from standard color as in bleaching. Such troubles caught near the source can be cured before there are large accumulations of damaged goods to be reprocessed or sold as seconds.

In spite of all precautions, there will still be some troubles—streaky dyeing, bleach that has turned yellow on storing, heels, toes and tops that do not match the rest, finishing oil that makes the labels greasy. You can think of plenty more. An unbiased judgment based on fact is needed, and it can best come from one who has no incentive to "pass the buck." For example, dyed mercerized cotton may be streaky from poor mercerizing, unwise choice of dyes, pure carelessness in dyeing, or possibly from uneven spinning. Very careful tests are often required for a positive statement, but such a statement based on evidence will be worth more than mere opinions from men who have an interest in avoiding responsibility for the trouble.

Troubles are inevitable in textile work on account of the great number of variables, some of which are always beyond control. An important but usually neglected part of the study of such manufacturing difficulties is making a record of them. Once the habit is established, careful records of mishaps, their causes and effects are very valuable in helping to prevent the same thing happening again. Such records, however, must be easily available and should be reviewed from time to time, not merely filed away and forgotten. The superintendent, dyer or other foremen do not have time to properly keep such records, but they can easily be a part of the regular laboratory service.

Introducing Research

The live-wire chemist will not be satisfied to stop with these more or less routine affairs, nor will the forward-looking executive wish him to. The knitting mills in most lines must continue to make staples, and just so far as possible to make them better and cheaper. Most of them also will have to devise novelties or follow the novelties of fashion for many years to come. A laboratory can co-operate with the designer in many ways perhaps not yet suspected. For instance, woven patterns have been prepared using several types of artificial silk where three or four pronounced colors could be obtained from a single dye bath. With the different kinds of silks now on the market and their varying affinities for different dyes, there must be a tremendous field, almost untouched as yet, for variety in hose and knitted outerwear.

Many such possibilities can be demonstrated by carefully planned series of dye tests. These will suggest new styles, then further tests, and finally the interpretation of laboratory results into terms of practical production.

Such work suggests and leads directly to research. The problems of to-day and to-morrow may have research features, but research on a real scientific basis is more likely to mean experiments for the future. It can begin with the careful collecting of plant records; the behavior, for example, of yarns from certain classes of stock, or of different counts on particular machines and covering both production and seconds. From such simple matters it is but a few steps to more complicated affairs and their influence on the weight of goods, on cost, and eventually on profits. Although not at all chemical, much of this matter can be handled through the laboratory by men who realize the importance of details and the necessity for true averages in the results.

As one of its achievements, chemical research has already resulted in the commercial production of at least four distinct kinds of artificial silk. Only one or two of them have found a wide market, but it has grown so rapidly that their utilization is outstripping the actual knowledge of the fibers and their manipulation. The large user who can afford it should take up the matter where the manufacturer has apparently left off, and extend the research through his own manufacturing processes to the finished product and its behavior in storage and use until every detail is understood.

Valuable research results have been obtained in other textile fields, but when it comes to the investing of money in such enterprises our English friends have gone far beyond us. The British Cotton Industry Research Association, made up of the larger share of British cotton manufacturers, is spending several millions on a five-year program and they have started by studying the humblest of things, the kinks and convolutions in the tiny separate fibers of cotton lint and the various properties of cotton yarn, things that we usually assume that we know all about. Since they are also working in the same way with the other textile fibers, who knows how soon they may get 'way ahead of us and start to flood our markets through better or more novel styles or lower costs?

Without further detail, business men who have tried it have found even highly scientific research profitable. In a single plant or a group of mills a chemical laboratory is the simplest means of approach to the application of science to practice. Given a fair chance, it will prove its worth, and in the face of all the evidence from textile and other sources the mill that can use chemistry and does not is carrying on a self-imposed handicap.

Choosing the Chemist

Now, if you have decided to "take a chance on a chemist" the next problem is one of selection. This will depend upon what you decide shall be his status in the plant. You can hire a young man to assist the dyer by making tests, but, needless to say, this will not have much effect upon the destiny of your company. The next level would be the equipping of a small laboratory independent of any other department with a chemist fresh from school to operate it. This may be the best plan for a small place, but it is necessarily slow, as everything has to be worked out from the ground up. Chemists can, however, be obtained with any degree of experience, will require corresponding compensation but will produce corresponding results, and the more the experience the sooner will the results be adding their contribution to profits. At the top of the list we can have a man who has spent enough years in textile and chemical research to rather quickly establish a going laboratory for new developments and handle the more routine types of work as a side line; or, on the other hand, a mature chemist of broad enough experience to quickly work out the various lines of testing, grasp the theoretical and practical aspects of the dyeing and chemical processes, and, possibly in the role of assistant superintendent, assume general supervision over them.

By this we do not mean standing in the dyehouse office matching shades, for that is the dyer's job. We do include a continuous study of costs of dyes and of the dyeing process, special assistance when getting out samples and new shades, analysis of difficulties, and so on with authority to apply remedies. Precedent, if needed, can be found in other branches of textiles where superintendents of dyeing are sometimes laboratory rather than dyehouse men, and therefore have a broader view and a realization that the objective is not merely to get certain goods through the dyehouse but to harmonize it with other plant departments and with sales.

Finally, a laboratory can serve as a center of education for a whole plant. Boys who start as dishwashers learn care and attention to detail as well as technical points, and can graduate to positions in the plant carrying some responsibility. Assistant chemists can develop into second hands and foremen. Where there is any form of employee instruction, valuable lectures and demonstrations can be contributed. Contact of foremen, department heads and superintendents with a laboratory department that decides all issues on the merits of each case, introduces new methods of attacking puzzling problems, and substitutes certainty for guesswork, has proved to be a broadening and educating influence, with a consequent effect all through the plant.

John Campbell & Co. are distributing a new color card, "Level Dyeing Acid Colors on Dress Goods," which shows twenty-four sample swatches dyed in as many shades, ranging from light yellow and orange down through carmines, browns, grays and greens to blues and black. Along the bottom strip of the unfolded card is printed, "Enter goods at 120 deg. with 10 per cent Glauber's salt and 4 per cent sulphuric acid. Bring to boil and boil forty-five minutes to one hour."

Emulsions in the Textile Industry

Use of Emulsions in the Textile Industry—Use of Solvent in Aqueous Medium—Preparation of Emulsions—Nature of Protective Emulsifier—Properties of Soap and Gelatine Emulsions—Size of the Particles—Characteristics of Soap Emulsions—Importance of the Internal Surface Area—An Example to Illustrate Important Point—Conclusion

By DR. KURT LINDNER

(*Textilberichte*, 1923, *pages* 581-2)

Translated by Ismar Ginsberg, B.Sc., Chem. Eng.

EMULSIONS have been known for quite some time and the average person comes in contact with them every day, as, for example, in the form of milk, in many plant juices, in pharmaceutical preparations, in photographic plates and films, etc. In spite of this, within recent years comparatively no research work was performed in this field from the physical-chemical standpoint to determine the conditions which govern the formation and existence of such emulsions, particularly with respect to their often very striking effectiveness in producing certain results.

It may also be said that at the present time there is still left much that has to be done in this field in order to clear up the conditions and the laws that apply to the formation and the existence of emulsions, which is a very complicated matter. Before going any further, it must be mentioned that all emulsification problems must be considered from the purely physical standpoint, as in the last analysis the problems are always concerned with a change in the state of the substance. There is no difference made in such a study from the purely physical standpoint whether or not the material that is emulsified is actually converted into the state of an emulsion for the purpose of carrying out certain chemical reactions, as in the case of the highly sensitive silver bromide which is contained in the emulsified photographic film or plate coating. In many cases, as, for example, in the emulsions that are employed in textile chemistry and technology, the emulsified substance exerts principally physical functions—that is, a solvent action.

Use of Emulsions in the Textile Industry

Emulsions are mainly employed in the textile industry for washing and cleansing purposes. They are intended to substitute the more expensive soaps and also to increase the effectiveness of these to some extent. The active ingredients of the emulsions that are employed for textile-chemical purposes, are organic liquids, which are principally characterized by the fact that they are all excellent solvents of fats, oils, waxes, asphaltic substances, resins, tars, and mineral oils of all sorts.

When such solvents are employed it is possible easily and quickly to remove impurities in the textile fiber or the cloth, which are not affected by soaps, or pure alkaline washing agents, such as lyes, soda, etc. The first possibility that is presented is to use the solvent directly in the cleansing operation and actually to extract the impurities from the goods. Then the solvent may be recovered by distillation and separation from the fats, mineral oils, etc., that are dissolved in these solvents. It is possible in this way to recover about 95 per cent of the original solvent employed. However, the loss of solvent is always quite considerable in the case of the easily volatile solvents, and as a rule this loss is greater than what is proper for rational and economic removal of the foreign matters that contaminate the textile fiber. Then again, when the solvent used possesses a high boiling point, the direct extraction process becomes expensive because of the greater cost of recovery of the solvent from the standpoint of fuel consumption.

Use of Solvent in Aqueous Medium Preferred

From this standpoint the use of fat solvents in an aqueous medium is preferred, for the reason that in such a process from one-half to two per cent of the fat solvent, figured on the weight of the goods, is sufficient for the complete removal of all fats and fatty substances from the textile fiber.

But as the solvent, as a general rule, particularly one that will remove fats and fatty substances, is insoluble in water, it is necessary to emulsify it and in this way convert the solvent into a form that can be mixed with the water in the washing bath.

Nature of Such Emulsions

Such emulsions are generally systems in which the fat solvent is distributed in the form of numberless minute drops in the water medium. In this case water must always be the closed phase, as it is called, and the fat solvent the dispersed phase; that is, it must form the phase in which the particles of the substance are distributed throughout the mass of water. For example, there must not be any drops of water distributed throughout the organic solvent, as such emulsions cannot be diluted with water, but only with the organic solvent itself or other similar organic substance. A

(*Continued on page* 242)

Artificial Silk and Wool Hosiery

Use of a Revolving Cylinder Type Machine for Dyeing Stockings—Dyeing Solid Colors—Dyeing Two-Color Effects—Various Methods Used

By LOUIS G. HAYES

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A HOSE knitted from a combination of artificial silk and worsted has established a place for itself in the hosiery market for both the ladies' and gentlemen's trade. Stockings knitted from these two fibers are found in a variety of styles of knitting, a few being as follows: one being a stocking knitted from a thread that is woven from a stock in which the artificial silk and wool have been carded together, another where the artificial silk yarn and wool have been twisted and the stocking knitted from the twisted yarn, and a third where the artificial silk and wool yarn have been plaited so that the outside of the stocking is artificial silk while the inside and heel and toe are wool. Stockings knitted by these methods naturally give a varied effect, which is further accentuated by the subsequent dyeing operation.

Character of the Fibers

These two fibers represent two distinct classes, the artificial silk belonging to the vegetable class, while the wool represents the animal fibers. Each of these is dyed with a different class of dyestuffs, and it is possible to dye either fiber practically any desired shade and leave the other unstained. This fact opens practically an unlimited field so far as varied effects of color combinations are concerned, and some very beautiful color contrasts have been obtained.

In the dyeing of these stockings several entirely distinct methods of dyeing are brought into play, and it is the object of the writer in this article to describe the same and give a few practical recipes illustrating the various methods. Naturally, one of the essential points in the choice of dyestuffs for this class of work is superior fastness to washing and rubbing, while the light fastness is secondary. As a rule, however, dyestuffs having the two above-mentioned qualities are generally fast to light.

Machines for Dyeing Stockings

These stockings are most generally dyed in revolving cylinder type machines, such as a Smith-Drum or a Klauder Weldon machine, both of which are constructed of Monel metal, which has no effect on the dyestuffs employed. The machine itself is cylindrical in shape, being entirely perforated and divided into either two, three or four compartments, depending upon the make of machine. The machine generally makes two or three complete revolutions through the dye liquor, and then reverses automatically, this motion acting to lessen the tendency toward tangling, especially in the long hose. A great many stockings are still being dyed in the open tubs, however, and when so dyed are handled and "poled" much after "poling" of raw stock in the open tub.

As before mentioned, several different types of dyeing methods are employed in the coloring of these stockings, entirely dependent upon the effect desired, and the dyer is forced to be familiar with the following methods: Cotton or direct colors; acid colors; top chrome colors, and speck dyeing. Perhaps the best way to illustrate these different methods would be to give working examples of the methods used to produce the different effects.

One-Bath Method of Dyeing Solid Colors

Solid shades are those in which the artificial silk and wool are both dyed exactly the same shade. This form of dyeing should be done by a "one-bath" operation regardless of the shade desired, as there is on the market to-day an ample supply of the various dyestuffs needed to produce any shade and have the required fastness properties.

This work is done with a class of colors known as "union" colors, which have the property of dyeing animal and vegetable fibers practically the same shade from a neutral salt bath. Owing to the exceptional affinity of artificial silk for the union colors, it becomes necessary to add to the dye bath a certain quantity of neutral wool colors—that is, acid colors which dye from a neutral bath—to bring the wool to the exact shade desired. Care should be taken in the choice of dyestuffs to choose those that are exceptionally level dyeing, so that no trouble is caused by lack of penetration in the heel and toe, which are tightly woven.

The general procedure in dyeing is first to thoroughly wet out the stocking in the machine in water raised to 120 to 130 deg. Fahr. for ten to fifteen minutes, then to drain off the machine and to fill with clear water, which is then raised to 90 deg. Fahr. The previously well-dissolved dyestuff is then added, and after the dye is evenly distributed through the stockings the salt is added. This precaution as regards salt may be dispensed with when dyeing dark shades, but should be carefully followed to obtain the most uniform results on the lighter mode shades. The dye bath is then

slowly raised to the boil during one-half hour, during which time the artificial silk is dyed, and the boiling continued for one-quarter to one-half hour, or until the proper shade is obtained.

There are several color combinations on the market especially for the darker shades, such as cordovan, navy and black, that require an after-treatment to give them the required fastness. While this should not be necessary with the proper choice of dyestuffs, it is carried out by the following method: After the goods are dyed and well washed they are entered into a fresh bath at 130 to 140 deg. Fahr. containing 1 per cent of bichromate of potash and 3 per cent acetic acid, and worked for one-quarter to one-half hour, after which they are thoroughly washed.

This operation should be dispensed with whenever possible, as it adds to dye cost and makes the goods harsh, which slows up the work of the "boarders," as well as increases the number of "seconds." A few practical working formulas using dyestuffs of the best fastness are as follows:

Otter—Per 100 pounds—

3¼ oz. Diphenyl Catechine G
1 oz. Direct Black FR Conc.
145 gr. Polar Orange R Conc.
½ oz. Polar Yellow 2G Conc.
½ oz. Acid Milling Black B Special
10 lb. Common Salt

Log Cabin—Per 100 pounds—

3¼ oz. Diphenyl Catechine G
4 oz. Diphenyl Catechine BB
2 oz. Direct Black FR Conc.
1¼ oz. Polar Orange R Conc.
2¾ oz. Acid Milling Black B Special
1 oz. Polar Yellow 2G Conc.
10 lb. Common Salt.

Cordovan—Per 100 pounds—

2 lb. Diphenyl Brown ND
¾ lb. Acid Brown RN
1½ lb. Acid Milling Black B Special
¾ lb. Polar Yellow 2G Conc.
1½ oz. Direct Black FR Conc.
20 lb. Common Salt.

Light Gray—Per 100 pounds—

1½ oz. Diazophenyl Black V
140 gr. Diphenyl Brown ND
2 oz. Acid Milling Black B Special
140 gr. Polar Orange R Conc.
5 lb. Common Salt

Navy—Per 100 pounds—

6 lb. Union Blue N
20 lb. Common Salt

Black—Per 100 pounds—

8 lb. Union Black AW
20 lb. Common Salt

It will be noticed that the polar colors are used as shading colors in all of these formulas; and while the same shades are obtainable with the less expensive colors, such as Azo Yellow and Acid Orange, the wash fastness is very poor, while the polar colors are excellent and are very level dyeing.

Two-Color Effects

There are two methods of producing two-color effects on hosiery of this class: one by the single-bath method, using a combination of dyestuffs, both neutral wool colors and direct colors, that dye these two fibers contrasting shades, and a two-bath method where the wool is first dyed either acid or chrome colors and the artificial silk then dyed to shade in a fresh bath at a low temperature.

The two-bath method is a considerably longer dyeing operation, taking approximately twice as long to dye as the single-bath method; but the advocates of this process claim superior fastness to washing by this method, especially when chrome colors are used. Generally speaking, this is so; but the writer believes that with the proper choice of dyestuffs results that are just as fast to washing can be obtained by the single-bath method. It must be borne in mind that artificial silk has very little tensile strength when it is in the wet state, and the least handling it receives in this condition the better results as regards seconds are obtained. Therefore the writer believes the single-bath method should be employed whenever possible.

The dyeing process for these two methods is as follows:

Two-Bath Method of Dyeing

Two-Bath Method.—The stockings are entered into the machine with the proper quantity of water which is raised to 90 deg. Fahr. The previously well-dissolved color is then slowly added, and after the goods are thoroughly saturated with the dye solution 5 per cent acetic acid (28 per cent) is then added. The dye bath is then slowly raised to the boil and boiling continued for one-half hour. If the dye bath is not exhausted after boiling this length of time it is best to add a further 5 per cent acetic acid or 2 per cent formic acid and boil for one-half hour longer. Under no circumstances should sulphuric acid be used, as it is practically impossible to free the goods entirely of this acid, and it causes tender goods owing to its action on artificial silk when it is stored. The necessary amount of bichromate of soda, depending upon the depth of shade and colors used, is then added and the goods boiled a further one-half hour.

The stockings are then thoroughly washed to free them from any acid and the kettle refilled with water at 90 deg. Fahr. The necessary direct colors are then added to bring the artificial silk to shade, and 10 to 20

per cent common salt added and the temperature of the bath is raised to 110 to 120 deg. Fahr. and run one-half hour, after which the goods are rinsed.

Single-Bath Method of Dyeing

Single-Bath Method.—The stockings are entered into the machine at 90 deg. Fahr. and the proper mixture of colors added to obtain the shade. After the goods are wet through with this dye solution, 10 to 20 per cent of common salt is added and the bath raised to 120 deg. Fahr., at which temperature the stockings are run for one-half hour dyeing the artificial silk. The bath is then raised to the boil and boiling continued for one-half hour, during which time the wool is brought to shade and whatever additions of dyestuffs necessary are made.

When the wool is to be dyed and the artificial silk left white, either the top-chrome or acid method is used. As regards fastness the chrome method is superior, but for delicate shades, which generally require the shading of each bath to bring them to shade, the acid colors serve best. The dyeing procedure for acid colors is carried out the same as above mentioned for chrome colors, other than it is not necessary to use the bichromate of soda.

A few practical examples of these three methods are as follows:

Chrome Method

Wool Orange and Silk Green—
1.00% Terra Cotta RS chromed with
1.00% Bichrome and the silk dyed in a fresh bath with
0.50% Direct Sky Blue FFB
0.50% Direct Yellow 2G with
20.00% Common Salt at 120 deg. Fahr.

Wool Black and Silk Orange—
5.00% Erio Chrome Black A chromed with
1.50% Bichrome, and the silk dyed with
1.00% Polyphenyl Orange RN with
20.00% Common Salt at 120 deg. Fahr.

Wool Navy Blue and Silk Light Blue—
2.50% Sulphoncyanine 5R Extra dyed with acetic acid and the silk dyed in a fresh bath using
0.50% Direct Blue 6B dyed with
10.00% Common Salt at 120 deg. Fahr.

Single-Bath Method

Wool Orange and Silk Green—
0.60% Polar Orange R Conc.
0.40% Polar Yellow 2G Conc.
0.50% Direct Sky Blue FFB
0.50% Direct Yellow 2G dyed with
20.00% Common Salt as per the method above mentioned.

Wool Black and Silk Orange—
4.00% Acid Milling Black B Special
1.00% Diphenyl Orange ORN dyed with
20.00% Common Salt

Wool Red and Silk Navy—
2.00% Polar Red G Conc.
2.00% Diazophenyl Black BH High Conc. dyed with
20.00% Common Salt

Wool Dark Brown and Silk Tan—
1.00% Polar Orange R Conc.
1.00% Acid Milling Black B Special
0.50% Diphenyl Orange ORN
0.25% Direct Blue 2B Conc. dyed with
20.00% Common Salt

White Effects

Bright Blue and White—
1.50% Acid Pure Blue R Supra dyed with
5.00% Acetic Acid

Bright Green and White
2.00% Erio Viridine B Conc. dyed with
5.00% Acetic Acid

Navy and White—
3.00% Sulphoncyanine 5R dyed with
5.00% Acetic Acid, or
3.00% Erio Chrome Blueblack R Conc. dyed by the top-chrome method, using
1.50% Bichrome

Black and White—
4.00 to 5.00% Naphthol Acid Black W dyed with
5.00% Acetic Acid, or
5.00% Erio Chrome Black A dyed by the top-chrome method, using
1.50% Bichrome

When union colors are being used in dark shades and these colors are such that they need an after-treatment, this method is carried out in the following manner: After the dyeing operation is completed the goods are thoroughly washed and the machine filled with water, which is raised to 100 deg. Fahr., and 3 per cent acetic acid, 1 per cent bichrome or 2 per cent fluoride of chrome are added and the temperature of the bath raised to 130 to 140 deg. Fahr. and the goods run for twenty minutes, after which the stockings are thoroughly rinsed.

This treatment is apt to make the hosiery a little harsh, and it is a good policy to soften them in water at 110 deg. Fahr. with the addition of 1 per cent of some good softener, such as Preminole or Monopole oil, and to extract the goods without rinsing.—Color Trade Journal.

The Bleaching of Paper-Making Fibers

Part II

Water in Bleaching—Antichlors—Washing the Bleached Fiber—Kinds of Fiber Bleached—Effects of Bleaching

By E. SUTERMEISTER

THE third factor which has been mentioned as influencing the bleaching operation is that of the character of the water. In most cases the bleach consumed by the water is slight, but if the supply is badly contaminated with trade wastes or contains much organic matter, as in swamp waters, the loss may be appreciable. Griffin and Little give the bleach consumption of three different waters as 1.16, 1.77 and 3.87 grains per gallon, equivalent to 0.166 to 0.553 pounds per 1,000 gallons. When bleaching is carried out at a density of 3 per cent, a bleach consumption of 0.553 pounds per 1,000 gallons of water amounts to a little more than 0.2 per cent of bleach on the weight of the fiber. The sources of these three waters are unknown, so it is impossible to say whether they represent badly contaminated supplies or not, but tests of a river water which was considered unusually good for a mill supply showed that it occasionally ran as high as 0.115 pounds of bleach per 1,000 gallons, and that it averaged about 0.127 pounds. It is true that these figures are not large, compared with the normal bleach consumption of most fibers, but they show that the water supply of a bleach plant should be carefully looked into and also indicate one advantage, however small, of bleaching at high densities. This argument, of course, applies with greater force the more impure the water supply.

Antichlors

It is generally considered that bleached fiber going to the beater, or over the drying machines if the pulp is being run off in rolls, should be free from bleach. To remove the last traces of bleach and insure the absence of all active chlorine it is still customary in some mills to treat the fiber with some form of antichlor. The materials used include sodium thiosulphate, and the sulphites or bisulphites of sodium and calcium, while others which have been proposed are hydrogen peroxide and the mixture of calcium thiosulphate and polysulphide prepared by boiling sulphur with milk of lime. Thiosulphates are not to be recommended, since they form hydrochloric acid during their reaction with the bleach and may decompose in such a way as to set free sulphur. Sulphites are less harmful, but the lime-sulphur mixture is probably even worse than thiosulphate. The safest antichlor of all is hydrogen peroxide but it is too expensive for commercial use.

While there are times when the use of an antichlor is of assistance its regular employment indicates inefficient methods of operation, since expense is being incurred in destroying a portion of the bleach which should be employed in doing useful work. In any mill where careful technical control prevails it should be possible to eliminate all use of antichlors.

Washing the Bleached Fiber

There seems to be a decided difference of opinion as to the necessity or desirability of washing the bleached fiber. In the Dobson process, where dry sheets of fiber are added to the bleach in a drum-like vessel, it is claimed that the stock needs no washing or draining, but is ready for use as soon as the bleaching is completed. Others go just as far in the other direction and claim that the fiber should be very thoroughly washed. It is probable that for the general run of book and magazine papers too much stress is laid on the importance of thorough washing, while for some other grades it is true that the removal of bleach residues is quite essential.

As already mentioned washing is accomplished by drum washers or by some type of drainers. In addition there are mechanical devices to serve the same purpose, some of which act on the principle of alternate dilution and extraction of water. One washer of this type, constructed in the form of a wet machine, in which the stock is diluted twice and passes twice between squeeze rolls, removes well over 90 per cent of the soluble chlorides present It is, however, not very economical of water.

One of the most obvious results of washing is the removal of any unconsumed bleach, and when the washings gave a pronounced test for bleach it was formerly quite general to use them over again in breaking up fresh lots of fiber. If extremely large amounts of bleach are present this may be economical, but where only small quantities are present it is a wasteful practice, for the organic matter dissolved by the bleach solution from the fiber previously bleached continues to use up bleach when more is added. If it is desired to use such washings, or "back water," arrangements should be made to wash the fiber after the bleach in the back water has been exhausted and before fresh bleach is added. Such an intermediate washing can very well be applied to regular operations by adding about a third of the bleach, washing when this is all used up, and then adding the rest of the bleach. In actual practice this method has been

found to save about 10 per cent of the bleach necessary when all of it is added at once.

Besides traces of bleach the chief materials removed by washing are calcium salts, chiefly chloride from the reduction of the hypochlorite, and organic matter dissolved by the slightly alkaline bleach solution. The lime salts, it is often claimed, interfere seriously with the rosin sizing of the paper, but experiments by the writer have proved that just as good sizing was obtained in the case where the stock was mixed with back water as when fresh water was used. From this it appears that the importance of removing calcium salts from the bleached fiber is very much overestimated. It is quite different in the case of organic matter, for this is of a dark, yellowish brown color when it dries out, and its presence injures the color of the fiber very appreciably. This is not its only fault, for it is a very efficient froth producer, and if it is left in the fiber there is likely to be a considerably increased formation of foam on the paper machine. For these reasons, rather than because of the presence of calcium chloride, washing of the bleached fiber is beneficial.

Kinds of Fiber Bleached

When bleaching rags it is customary to add a little acid toward the end of the reaction to hasten the action of the bleach and assist in the production of a good white. The acid is added either in the Hollander or, after diluting largely with water, to the stock in the drainer.

Soda and sulphate fibers may be treated with a little acid during bleaching if it is desired. It is thought by some to hasten the action, but it is doubtful if the small amount generally used is of enough assistance to be worth the expense and trouble. It is seldom used in well regulated plants, though it has been demonstrated on a laboratory scale that it does improve the color of the bleached fiber under certain conditions.

With sulphite fiber the addition of acid tends to increase chlorination of the fiber with consequent production of a yellow color, and for this reason it is not used regularly. Sulphite may be bleached by adding acid about an hour after the bleach and following by a washing treatment and a rebleaching with a small amount of hypochlorite. Under these conditions the acid causes a very rapid exhaustion of the first part of the bleach and the whole process is shortened. While this process saves bleach and produces a very good color, it is unnecessarily complicated for fiber which has been cooked with the idea of making it into bleached fiber.

Jute and manila are generally bleached only to a cream shade, for the fibers are usually cooked only lightly in order to preserve their strength, and they reach the bleaching operation in such a highly lignified state that a full white cannot be reached without injury to the fiber. The recently introduced DeVains process for preparing fibers, which is a commercial development of Cross and Bevan's method for cellulose determinations, is said to produce snow-white fiber from such materials as jute and manila.

Ground wood bleaching is entirely different from that of all other paper-making fibers in that it employs a reducing instead of an oxidizing agent. Sulphurous acid or a bisulphite solution is applied to the fiber as it is run off on the wet machine, and the bundles or laps of fiber are piled up and allowed to stand for some time. The whitening action takes place slowly, but cannot be considered a true bleaching, for the color is not destroyed and returns on exposure to the air for some time.

Effects of Bleaching

The color change due to bleaching has been studied by Sindall and Bacon by means of a Lovibond tintometer. They show that the red and blue are not so pronounced in pulps as the yellow, and that while they disappear during bleaching at about the same rate they are both practically eliminated before the yellow reaches the vanishing point. This explains why bleached pulps nearly always have a yellowish hue rather than a reddish or bluish tone.

Bleaching is practically always accompanied by a loss in weight which varies with the kind of fiber and the amount of bleach it requires. This loss will also vary with the completeness of washing of the unbleached stock, for with sulphite, at least, this is seldom so completely washed that a further washing with pure water will not remove small amounts of impurities. Such loss will vary from a few tenths of a per cent for well treated fiber up to 4 per cent or even higher for stock which has been washed in part with sea water. The loss due to the chemical action of the bleach under average conditions is about 1.0 to 2.0 per cent for soda fiber, while for sulphite it is much more variable because of the greater range in quality of fiber. An easy bleaching sulphite of, say, 5 per cent bleach consumption, may lose only 1.0 per cent, while a hard bleaching stock requiring 20 per cent, or more, of bleach, may lose as much as 5 per cent of its weight. In general, it may be said that the more bleach the fiber requires the greater will be the loss on bleaching. With the same fiber bleached to varying degrees of whiteness it is also true that the more bleach used the greater the loss. This is well illustrated in the following table:

——Sulphite Fiber——		——Soda Fiber——	
Per Cent Bleach Used.	Per Cent Loss on Bleaching.	Per Cent Bleach Used.	Per Cent Loss on Bleaching.
5	1.66	11.5	1.94
15	3.59	20.5	3.69
25	5.72	30.5	8.03

If the fiber is treated with an excess of bleach, which is not all used up when the desired degree of whiteness is reached, an increase in temperature would be expected

to increase the loss in weight, and this has been found to hold true in bleaching sulphate pulp.

The effect of bleaching on the strength of the fiber has not yet been proved to the entire satisfaction of everyone. Frohberg, working on sulphite fiber, found that bleaching very greatly reduced the folding strength when compared with paper made from the unbleached fiber. This reduction amounted to 29.8 to 62.7 per cent of the strength of the unbleached pulp in the nine samples which he tested, while a slight overbleaching reduced the strength still more. The writer's tests gave directly opposite results and proved that sulphite bleached to a good white color had greater bursting and folding strength than the same fiber unbleached. Strong overbleaching reduces the strength quite appreciably from the maximum point, but it is still higher than the tests on the unbleached fiber. Soda fiber, on the other hand, does show a decrease in strength as bleaching proceeds. It seems to be the opinion, from the results of observations in a number of mills, that bleached fiber makes at least as strong paper as the same fiber in the unbleached state.

Bleaching is likely to cause certain changes in the chemical characteristic of the fibers, the principal one being the formation of oxycellulose. In addition, there may be a formation of hydrocellulose if acid is used, or possibly a slight chlorination of the fiber under certain conditions. Work carried out by Schwalbe under quite varied conditions led him to conclude that there was no appreciable chlorination of the fiber during the bleaching of sulphite pulp and that the products of bleaching are removed during the washing process.

The formation of oxycellulose during bleaching may be followed by determining the copper number, according to Schwalbe's method, or by determining the loss in weight when the bleached fibers are boiled in dilute alkali. Both of these methods demonstrate that the more bleach used, and hence the whiter the bleached product, the greater will be the attack on the cellulose itself and the more oxycellulose will be formed. In a similar way it has been shown that permanganate bleaching causes less formation of oxycellulose than hypochlorite, equal whiteness being produced in each case. Schwalbe has also proved that acid bleaching attacks cellulose more than alkaline, both in hot and cold bleaching.

(The end)

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part II

Another Continuous Dyeing Machine—The Working of the Plant—Advantages of the Plant—Defects—Dyeing with Weak Solutions—Another Type of Machine—Its Working Process and Advantages

By RAFFAELE SANSONE

Another Continuous Dyeing Machine

IN some works the dyeing of the bright colors and shades with direct dyes is conducted on a special form of continuous machine constructed on the principle indicated in Fig. 1 (page 233).

This shows six galvanized iron vats (A, B, C, D, E, F) joined one against the other so as to form a single long vat. At the end of each vat is fixed a pair of galvanized iron cylinders (G, H, I, L, M, O) on which a light pressure is applied through levers and weights. This pressure can be removed from all pairs of rollers simultaneously through a special arrangement when it is necessary to enter the tapes or to treat the cloth without pressure.

The first of such compartments is used for wetting out the cotton cloth with a bath of weak carbonate of soda, the second and third for dyeing, and the fourth, fifth and sixth for thorough rinsing and for preparing the material for the following drying operations.

The first three vats are supplied with a perforated galvanized iron steam heating coil, while the last three have no heating means. Before the first vat is arranged a high double frame (P) having several entrance rollers containing inclined lines that spread the cloth entered from below from a small iron wagon on rails or from a table, as may be most convenient. At the back of the plant is also placed a high double iron frame (N) supplied with a plaiting arrangement (R).

In the second and third vats the dye bath containing the coloring matter, fixing agent, etc., is entered separately, so that the cotton cloth is treated with two independent baths of the same color or of different colors, in accordance with the effect desired.

The rinsing water in the last three vats (D, E, F) enters from the bottom of each and escapes at the top through several overflow pipes, being forced upward rapidly to create a quick, thorough rinsing.

The plaiting mechanism (R) is composed of a rocking frame terminating in a pair of gripping rollers, moved backward and forward for a certain interval, regulated in accordance with the width of the pieces

(Continued on page 233)

Proceedings of the American Association of Textile Chemists and Colorists

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FEBRUARY MEETING, NEW YORK SECTION

Following the usual informal dinner, the regular February meeting of the New York Section of the American Association of Textile Chemists and Colorists convened in the Hotel Breslin at 8.30 p.m., Friday, February 29, 1924, Chairman E. H. Killheffer presiding.

. . . After the formal business of the Section was transacted and the guests had been introduced, Chairman Killheffer presented the speaker of the evening, Professor Harold Hibbert, of Yale University, who addressed the members as follows:

DEVELOPMENTS IN CELLULOSE CHEMISTRY AND THEIR APPLICATION TO THE TEXTILE INDUSTRY

By Dr. Harold Hibbert

Dr. Killheffer and Gentlemen: I feel much honored by the invitation to come and talk to you, but somewhat embarrassed by the fact that I realize I am talking to men who know considerably more about many phases of the subject than I do.

However (speaking as a scientist), I hope you will have patience with me to the extent of allowing me to explain just what it is the chemist is endeavoring to develop with regard to the constitution of cellulose.

When you take a piece of wood such as this (indicating) and consider that it is the stem of an ordinary sunflower (the growth of a short four or five months' peperiod) you will admit that it represents a marvelous transformation. You have here, in fact, the most efficient factory in the world. Your overhead charges amount to very little, and it does not cost anything for labor.

We know that the first change in plant growth is the interaction of carbon dioxide and water to give formaldehyde, this taking place under the active rays from the sun, and in the presence of a catalyst, chlorophyll (illustrating on blackboard). This formaldehyde in presence of the alkali in the plant is then converted into sugar.

As to the next change, all we know is that this (indicating) goes into starch during the period of maximum growth, and it also goes into cellulose, and that somehow or other the starch also changes into cellulose.

Some forty years ago a German chemist, Flechsig, treated cotton with sulphuric acid and claimed that he was able to convert the cellulose into glucose quantitatively. It is, however, only within the last four or five years that his claim has been substantiated by the work of Willstaetter and by that of Ost. The former showed that if you dissolve cotton in 43 per cent hydrochloric acid, in the course of two or three hours it is converted quantitatively into glucose.

This was confirmed by Ost who actually fermented the glucose present and obtained a yield of about 85 per cent of alcohol, indicating that the cotton cellulose molecule is derived entirely from glucose molecules.

It remained, however, for the well-known Scotch chemist, Principal Irvine of St. Andrews University, to provide the final proof. He showed that cotton could be converted into its methyl glucoside (illustrating) with the remarkably high yield of 94 per cent.

Thus it is now definitely established that cotton cellulose consists entirely of anyhydro-glucose molecules. It

can be represented by the formula $(C_6H_{10}O_5)x$, in which x is still an unknown quantity, but which is much smaller than formerly supposed.

It would mean relatively little to say that cotton, ordinary cotton, which you handle every day, is composed of anhydro-glucose molecules, were it not for the fact that for the past thirty years scientific experiments have been carried out at St. Andrews University for the purpose of ascertaining the constitution of a sugar from that of its derivatives. It has been known for some time that cellulose (calculated on the C_6 basis), contains three hydroxyl groups. Thus it is possible to prepare a trinitrate, namely, ordinary guncotton, and a triacetate, samples of which you see here (indicating), and to each $C_6H_{10}O_5$ there are three hydroxyl (OH) groups.

The point still remains as to how these are combined in the molecule. Some seven years ago I was interested in the nitration of sugar in glycerine and expected to find the five hydroxyl groups in the sugar replaced by five nitrate groups, just as you do in the case of glycerine, from which, as you know, we get glycerine trinitrate. Instead of getting five we only got three nitrated.

I shall not go into the theory underlying it, except to state that you see we have here a five-membered ring (illustrating), and in organic chemistry it seems to be a fundamental property of organic products that wherever atoms can tumble together to form either a five or six-membered ring, they attempt to do so.

The next logical step is that involving the loss of a molecule of water and ring formation. This could then either polymerize, as such, or you could have a number of molecules joining up in this way (illustrating on blackboard). The point to note is that cellulose, according to such a theory, would be formed from glucose by the union of a number of molecules through these two so-called gamma-delta positions. This was the theory and view I put forward about seven years ago when we knew nothing definite about the constitution of cellulose, and I ventured to predict that it would be found to be a polymerized product of this type, with the linkings here (illustrating on blackboard), and I can at least claim credit for this view having been proven correct.

As to the number of these cellulose nuclei in what we call the cellulose complex, there was no evidence at that time on which to base an opinion, so that it remained an open question as to the number of these which were joined together to produce cotton.

Through the magnificent work of Irvine and his fellow chemists, extending over some thirty years, this theory has been shown to be correct. This was done by what we call methylating, that is, replacing the hydroxyl by methoxy groups. It was shown by two of his co-workers (Denham and Woodhouse) that their methylated cotton on hydrolysis yielded a trimethoxy glucose, the constitution of which was definitely fixed and which in turn settled the place of union of the additional molecules.

We know to-day that the fundamental cotton cellulose unit is derived from either two (Pringsheim)—or three (Irvine)—of these joined together. Irvine submits good evidence—and I am inclined to agree with him—that three of these join together to give us what we may call the "building unit" for cellulose.

Cellulose itself consists of many more of these double or triple units. Pringsheim, in Germany, on the other hand, assumes that two constitute the cellulose nucleus. Only further experimentation can decide between them. In any event, these then polymerize, or couple together, by what we term "secondary valence," or attractive force, and cellulose is thus a cluster of units of this type.

What are the questions which confront you as practical men? All that we need to consider for the majority of your problems is the structure of a unit of this type (illustrating on blackboard) and to regard it strictly from the point of view of an organic problem in which we have present in each original glucose molecule one CH_2OH, or primary alcohol, group and two CHOH, or secondary alcohol, groups, together with a "latent" aldehyde group. All your reactions, your problems and the variations which occur in the technical processes are to be referred back to an organic product of this type, present in a highly polymerized form; namely, as a colloid.

Cross has referred to the fact, and has criticized me for desiring to regard the cellulose molecule in the light of any other organic compound. I think he has misinterpreted my views to this extent: I do not believe that anyone can take a synthetic organic product and predict what is going to happen to a similar natural product which is also a colloid. No matter from what source we obtain our cotton, there is no such thing as two cotton samples possessing strictly the same physical properties even though they come from the same location. In other words, there are always different amounts of waxes and pectins, while the actual colloidal state is somewhat different. Nevertheless, we know that in all cases we are dealing with a molecule comprised of three of these anhydro glucose nuclei, a considerable number of which are held together by secondary valencies, or, let us say, weaker attractive force.

What happens when we bleach or overbleach? The least resistant part of the molecule is this (indicating), which oxidizes either to the aldehyde (CHO) or to the acid (COOH), and the tendering is due to the oxidation of this primary alcohol group into either an aldehyde or acid, or both.

(Professor Hibbert at this stage discussed in detail the investigations on oxy-cellulose being carried out at Yale University, and pointed out their importance to the textile industry.)

These are samples of oxy-cellulose which we have recently obtained, and this (indicating) is the material from which it was made. You can see that is almost ready to drop apart, and if you treat it with caustic soda it will go into solution almost immediately. It is very brittle and was obtained by treating the original fabric with a neutral solution of a permanganate.

An oxy-cellulose of this type is produced under conditions which warrant us in assuming that no deep-seated change in the cotton molecule takes place.

Previous work on the subject has dealt with reactions involving more or less drastic treatment of cellulose, during which we know that deep-seated changes must have taken place. If a product can be prepared which is entirely oxy-cellulose, we shall be able to define its properties much more accurately and can then argue back as to the conditions which must rule in bleaching, and define the conditions which are most favorable to the bleaching operations as involving the least destruction and change in the cotton fiber.

I cannot go into the question to-night of what is "hydrocellulose" and what is "cellulose hydrate," but I will say just this before I commence to talk on the other aspects of the subject: that when we take a piece of cotton of this type—which being a professor's handkerchief is naturally cotton (laughter)—if we wish to ascertain the conditions involving maximum stability we must ascertain the conditions under which it is exposed to the least disintegration or change by chemical action.

Hence I come back to the point that artificial silks (viscose, cuprammonium and Chardonnet) are products differing in one essential respect from cotton; namely, a surface change such as is induced in "mercerization." We are activating the surface of our cellulose; we hydrate the cellulose; we cause the fiber to swell.

I think it is the tendency at the present time to proceed on the assumption that "surface activation" may eventually be brought about in such a way that it may not be necessary to get our cellulose in solution at all for the purpose of spinning, but that by altering our mercerization process we shall be able to bring about an activation of the fiber which will give us the luster, and at the same time sufficient strength, to imitate our artificial silk.

I am making this forecast—although it may be altogether wrong—that research work looking to the future will be active along this line; in fact, recent developments abroad indicate that by suitable alterations in the method of mercerizing it is possible to develop a much higher luster than is associated with the ordinary mercerized fabric.

We have assumed for too long that there is only *one* mercerizing agent and *one* set of mercerizing conditions.

I may mention at this stage that I was much interested last summer while traveling in Germany, France and England in observing the remarkable progress being made with regard to developments in textile chemistry.

The armistice was no sooner declared than the German Government apparently decided that research in textile chemistry was one of the things to be pushed. They evidently thought: "Well, we have got the Haber nitrogen fixation process pretty well settled; we don't need to bother with that any more." So they turned over the Nitrogen Fixation Laboratory in the Kaiser Wilhelm Institute to a research department devoted to the study of textile chemistry, and it is very remarkable to read the opening speeches and to note the work that is going on there. At one end of the game they are commencing with the simplest derivatives of sugar and finding out the nature of these ring compounds (illustrating), and at the other they are seeking information, for instance, on such a problem as: What is it that produces the difference between an ordinary crystalline compound, such as sugar, and that of a textile? What are the properties which we must impose on an ordinary crystalline derivative to produce a textile from it?

No doubt you have seen the various paper fabrics that were made in Germany during the war; here are two of them. They are not very good specimens. During the war they made a lot of paper clothing, but are evidently not devoting attention to changes which can be brought about by the chemist with a view to modification of a textile so as to provide a substitute for some other, for example, wool and silk.

Again in England at the close of the war the Government had certain war funds available and agreed to donate about half a million dollars for "research on cotton" provided the textile industries would agree to support the same, in other words, provide sufficient money for an institute devoted to this work. When I addressed the staff last summer in the new Shirley Institute for Cotton Research, in Manchester, England, I was much amazed on entering their fine library, which contains about two hundred journals of all kinds, to find present a force of some seventy scientific workers, botanists, physical chemists, organic chemists and others, all actively engaged on the solution of problems relating to the cotton industry. They are publishing treatises on such subjects as: "The Rigidity of Cotton Hairs," "Action of Light on Cotton," "Chemical Analysis of Cotton," "Oxycellulose," "The Comparison of Yarns Spun by

Various Systems," "Some Physical Tests on Sized Yarns," "Plasticity of Cotton and Other Materials," "Mercerization and Luster of Cotton," etc. They are proceeding in a very thorough, scientific manner. They are not publishing all their results—you cannot expect them to—but there is no doubt we shall have to pay the penalty here unless the industry awakens to the fact that research is necessary for the development of your particular field.

I should like now to take up a discussion of the various uses to which cellulose it put, and I will start with the subject of textiles since that is probably of greatest interest to you.

A good many years ago Cross and Bevan discovered that when you treat wood pulp or cotton with caustic soda and then add carbon disulphide, a colloidal solution of the cotton is formed, and that such material can be forced through a small opening in what is termed a spinnerette (of this type), and then into a "setting bath" (dilute acid), resulting in the precipitation of the cellulose in the form of a thread which can be reeled off. The spinnerette used is one of these two types (indicating), and the number and size of the small orifices determine the number of filatures and denier. These openings are very fine, and running an artificial silk plant is no light task, because the moment these small holes become plugged (and, of course, there are thousands of them) you have trouble. You can imagine the care that must be taken in filtration, etc., to secure continuous operation.

The first method developed was the "Viscose Process," viscose being the name applied to the solution obtained by treating cotton with carbon disulphide and caustic soda. When you precipitate the cellulose, all that you do is to regenerate it in a somewhat activated, hydrated form. The condition of the fiber (strength, uniformity, luster, etc.) depends on a variety of factors which it is not necessary to discuss, two of the most important being the mode of prepaartion of the viscose solution and the nature of the "setting-bath."

You are familiar with the luster of "viscose silk," and being merely cellulose it will dye just the same as ordinary cotton, and the treatment in consequence is much the same. These (passing samples around) are samples of viscose silk.

Up to the present it has not been possible, except in the case of "Celanese" (cellulose acetate) to spin very fine deniers—let us say deniers approaching natural silk—although great progress has been, and still is, being made.

I should observe that in the viscose process it is not customary to use cotton or cotton linters; it is much cheaper to use a highly purified wood pulp, which is then treated in the manner I have already described, so that what you really do is to convert "a piece of wood into a silk stocking."

When we come to the French Chardonnet Process we take cotton linters, nitrate them, and thus transform those three hydroxyls we were discussing a moment ago into nitrate groups, forming in this way ordinary nitrocellulose or gun-cotton. This is colloided, or brought into solution, with an ether-alcohol mixture, and then forced through the spinnerettes. It is not precipitated but spun "dry" in the form of a thread which is nitrocellulose.

It is obvious that we cannot make stockings and other things of gun-cotton. It would be a rather dangerous experiment. What we do is to pass this fiber through a bath of ammonium, or other alkaline sulphide, by which means our nitrate groups are destroyed, and we get back cellulose.

Chardonnet silk, similar to viscose, consists of nothing more than hydrated cellulose.

A third process consists in dissolving cotton linters in a solution of cuprammonium sulphate. The constitution of this varies, and a great deal depends on the right preparation of the solution. This is forced through the spinnerettes in the same way and passed into an alkaline "setting bath," giving us "hydrated copperized cellulose." The material thus obtained is then freed from copper by passing the thread through a bath of dilute sulphuric acid.

The Cuprammonium Process was developed in Germany, and is apparently more costly than the Viscose or Chardonnet, and therefore has not had the same vogue as the other two.

Since in each of the three cases we are concerned with the properties of an "activated cellulose," the material has a somewhat greater tendency to oxidize and to undergo change than is the case with cotton.

These three types of artificial silk give us a *cellulose* product; we may call it artificial silk, or any other kind of silk, but nevertheless it is simply a hydrated cotton and possesses all of the properties of such, including a marked hygroscopicity.

On the other hand, if we take cotton cellulose, which contains the three hydroxyl groups, we can replace the latter by acetyl groups. In other words, if we treat cotton with acetic anhydride under definite conditions, we replace the (OH) by the CH_3CO group, that is, instead of nitrating we acetylate. The product then contains on the C_6 basis three acetyl groups.

Bearing this in mind we are not surprised that such a substance should give us a new type of textile, and this is known as "acetate silk" or "Celanese."

What are the properties which the chemist might expect such a material to possess? In the first place, whenever we have hydroxyl groups present, we generally expect to find hygroscopic character. If we replace these by acetyl groups, then in accordance with chemical ex-

perience we should expect "Celanese" to be much less hygroscopic than cellulose, and as a matter of fact it is, so much so that there is a strong possibility of its being used for insulation purposes instead of natural silk.

It is a rather astonishing fact to learn that approximately 60 per cent of natural silk is used for insulating purposes. Naturally, the Japanese do not hesitate to put up the price as high as they can, and the use of cellulose acetate is now being seriously considered as a substitute for natural silks, since experiments have shown that it is extraordinarily stable and remains perfectly intact over long periods of time.

If cellulose acetate is dissolved in a given solvent—acetone, for example—and forced through the spinnerette, the thread can be reeled off by simply passing it through a drying chamber. The acetone is volatilized and you have these beautiful samples of acetate silk (Celanese) which the company was kind enough to loan me.

This (holding up garment) is one garment they rather pride themselves on. It is a fabric which has been worn for three years and washed some seventy times. You can see that it has stood up remarkably well. They are also able to spin very fine deniers. I will pass one or two of these around to show the material they expect to turn out in their American factory next June. By feeling this material you will see that it is scarcely distinguishable from real silk, so there appears to be quite a future for this material.

As practical men you know that if it were not for the hydroxyl groups in the cotton molecule you would have a great deal of trouble with regard to your dyeing problems, since the phenomenon of "dyeing" is intimately associated with their presence. In "Celanese" the (OH) groups are replaced by acetyl, and consequently you would scarcely expect this material (Celanese) to have the same affinity for similar dyestuffs that ordinary cotton, or artificial silk, possesses. As a matter of fact, this has been the principal hindrance to its development—the ability to dye satisfactorily.

However, by the adoption of new types of dyestuffs the claim is now made—and you will see by the samples that are passed around it seems to be substantiated—that it is possible to dye "Celanese" with a wide variety of shades to give you a material which has many qualities not possessed by other fabrics. Also—I speak now as a chemist, not as a technologist—it would seem from the nature of the material that it should probably be more stable and durable than Viscose Silk.

With the three artificial silks already mentioned, together with Celanese, cotton, wool and natural silk, we now have a choice of materials with which we can carry out a wide variety of operations. In other words, we have dyestuffs which will dye cotton and which will not dye acetate silk; dyestuffs which will dye neither acetate silk nor cotton, and dyestuffs which dye neither acetate silk, viscose, cotton or wool. It is thus possible to produce a wide variety of mixed color effects, through which a big new field for the textile chemist is opened up.

It is an interesting problem, and one worth the consideration of your Association, as to the real nature of the phenomenon which takes place when we hydrate cotton. When this is solved we shall have gone a long way toward the solution of the problem of accounting for luster and the different appearance of artificial silk as compared with cotton.

I should like, for a moment, to turn to other applications of cellulose; for example, the use of solutions of viscose. For instance, if we dip a glass tube of this type into our viscose solution it is covered with a coating of viscose, from which the cellulose can be precipitated by dipping it in an acid bath. The "casings" thus formed serve as "sausage coverings," "bottle caps," etc.

Depending on the size of the opening in the spinnerette, you can produce a variety of products. Instead of making a thread you can produce this horsehair (demonstrating sample).

The only other useful solvent for cellulose, apart from those mentioned above, is calcium sulphocyanate. This is a sample (illustrating) made by precipitating cotton from its solution in this reagent. Whether or not such solutions can be employed commercially is naturally a question as to the cost of production.

We have spoken up to now of solvents for cellulose which are useful for making threads. There is still another solvent, and that is zinc chloride. If we take paper made from cotton rags and pass the sheets through concentrated zinc chloride, at a moderate temperature, the paper swells and becomes jellified. If this material is then passed over a cylinder and one layer superimposed on the other, the sheets join together and we have formed a thick gelatinous product, about this size (illustrating), depending on the type of sheet required.

The product contains a large amount of zinc chloride and some hydrochloric acid, but by immersing in water the zinc chloride diffuses out and finally after drying we have left what is known as "vulcanized fiber." This again is merely hydrated cellulose, and all of these various products which you see before you are nothing more nor less than hydrated cellulose produced in this manner.

You are familiar with these various things (showing samples) for pulleys, brackets, radio work, automobiles, etc., which are samples of vulcanized fiber loaned me by the American Vulcanized Fibre Company.

Question—Is that suitable for insulating work?

Professor Hibbert—Yes, it is suitable and is used extensively; but it has one drawback: it is hygroscopic, as all the hydrated cellulose products are. If it were not for this property it would tend to displace Baekelite to a much greater extent than it does. It can be cut and sawn, and possesses that plasticity which makes it so valuable as compared with the somewhat more brittle character of Baekelite. The latter plays a very important role in industrial life, but what is desired is a material which can be molded and at the same time is not so brittle.

Of the other applications, one of the most important is that of the manufacture of photographic films, an industry founded on the use of nitrated cellulose or gun-cotton.

We may dissolve gun-cotton or cellulose nitrate in a solvent in one of three ways: In the first place, by the use of a volatile solvent—for instance, amyl acetate—in which case we form a lacquer from which the amyl acetate evaporates and leaves us a film of nitrocellulose. If we put in some bronze or aluminum powder we have our ordinary bronzing liquor for painting radiators and other materials.

In the second place, we may take a non-volatile liquid solvent, and this leads to the manufacture of artificial leather. What is artificial leather? It is made by colloiding nitrocellulose with a volatile solvent with which is incorporated castor oil. Cotton fabric is then coated with this "dope" so that after the volatilization of the solvent you have left a fabric of this type, "Fabrikoid," which consists of nitrocellulose, castor oil, filler and dyestuff, and on which you can emboss any given design. Artificial leather thus embodies the utilization of a *non-volatile* liquid. The castor oil keeps the nitrocellulose coating pliable and it does not change.

The third case is where we use a *solid* colloiding agent—for instance, camphor; and this brings us to the celluloid industry. If we again take our nitrocellulose and mix it with about twenty parts of camphor and the right proportions of alcohol, we get, on warming, a plastic mass which we can then submit to hydraulic pressure at a sufficiently high temperature to drive off the remainder of the alcohol. This gives us celluloid, of which these are samples. The graining is brought about by admixture with various oxides, and these products consist of nitrocellulose and camphor, the colloiding of the former being brought about by the latter.

These are the three main uses, although there are many other applications.

We have here a little device in the form of a non-fracturable glass. You take two sheets of glass of this type and put in between them a thin sheet of celluloid. You can break the glass by impact, but it will not splinter.

During the war one of the important problems calling for solution was with regard to the use of a suitable coating for aeroplane wings. Naturally, we did not wish to coat an aeroplane fabric with an explosive, namely, nitrocellulose, so a method for the manufacture of acetate of cellulose had to be developed.

Another war problem was with regard to a suitable eyepiece for gas masks. When the first of these were made and put into use, the men would start to attack and begin to perspire, and very soon the perspiration would settle on the eyepiece and they simply could not go any further; they would have to tear off the masks. That was a problem which gave much concern to the authorities and required much hard work before it was solved.

You will recall what I said about hygroscopic properties being associated with the presence of hydroxyl groups. In the cellulose acetate molecule, we have three acetyl groups, and the problem was finally solved by partial hydrolysis; in other words, replacing one or more of these by hydroxyl. Then we got a material sufficiently hygroscopic (that is, possessing the power to absorb water for a sufficient length of time), to keep the eyepiece clear, so that it answered the purpose desired.

I think I had better stop here. It is a subject on which one can ramble for a long time, but if any points come up I shall be glad to answer them if I can.

Chairman Killheffer—The meeting is open now, gentlemen.

Henry F. Herrmann—Professor, granting that the three common forms of artificial silk—such as Viscose, Cupramonnium and Chardonnet silk—in their finished form represent regenerated cellulose or hydrated cellulose, why it is that we experience such a marked difference in the dyeing properties? This can be passed over by saying that they all respond to substantive dyes, and yet there is a very marked difference in the affinity of these three types of silk so that they present varied problems to the dyer. There is such a marked difference that you couldn't possibly mingle the three fibers and carry out a dyeing process in the same dye kettle. Nor would you be able to find any one dyer equally skillful in handling all three varieties.

Is there any ready explanation for that?

Professor Hibbert—I think I should view the explanation somewhat as follows: One of the great troubles in the artificial silk industry in producing uniform quality is in the nature of the setting bath; that is to say, the conditions under which you precipitate your cellulose. You may read through the literature on the subject and

you may consult the various patents, but each manufacturer carefully guards the composition of the ingredients which go into his particular setting bath. When the cellulose precipitates out, you have a colloidal surface. That colloidal surface may be represented, for instance, by a molecule or a series of molecules of this size (illustrating on blackboard). In another case, it may be represented by hydration carried to this size. In another case it may be both. What we are dealing with is a hydrated product and a surface area, the nature of which varies with each man's process and you can say more or less with each batch.

Mr. Herrmann—I have experienced somewhat that same thing in testing an unskillfully produced artificial silk. Take, for instance, a skein of this character, half of that might dye differently from the other half, although apparently it passed through the same manufacturing process, but the coagulation might have proceeded unequally.

That at one time, I understand, put one manufacturer practically out of business because he was unable to control just that feature of it.

May I ask just one other question on acetate solution?

We were performing some experiments on the saponification of one or more of the acetyl groups, and we had reason to believe (probably incorrectly) that by carrying the saponification far enough one could convert a triacetate silk to the same form as a diacetate silk, or, in other words, a Celanese and a Lustron. I don't know whether I am right in assuming that a Lustron is a diacetate or a tri, but why theoretically would it be impossible to obtain even approximately the same product? We found that by saponifying a Celanese silk to a certain degree it became possible to dye it with a substantive color. But by subjecting the diacetate silk to the same saponification or, say, a saponification of half the strength, we did not get a fiber which could be dyed by the substantive color. We had converted the two to two entirely different products and were unable to get an explanation for it. Pure blackboard work didn't seem to answer the question.

Professor Hibbert—That, of course, brings up the whole subject of the theory of dyeing.

In the hydroxyl groups present in cotton cellulose you have a certain affinity for your dyestuff which can be increased with the necessary mordant. If you eliminate the hydroxyl groups you alter the affinity of the fiber to a very large extent, and the degree to which you alter it will vary with the percentage of elimination of the hydroxyl groups. Personally, I should expect a hydrolyzed product (except under very carefully regulated conditions and with material arising from one source) would dye differently, simply because when you remove the acetyl groups you must alter the surface of your fiber, the colloidal surface; you must alter the attraction of what remains, say a partly acetylated product, for the dyestuff.

Mr. Herrmann—But you believe it is impossible to get those two to the same condition by hydrolyzing, starting with a diacetate and a triacetate—it is impossible to get those two to the same condition by varying the hydrolysis.

Professor Hibbert—It is, for this reason: this is just theory and I give these opinions with reserve. If we consider this formula (cellulose acetate) we note that it contains two acetyl groups derived from a secondary and one from a primary alcohol. If we saponify such a product, which of these acetyl groups is going to saponify first? There naturally will be a partition. This (indicating by illustrating on blackboard) should saponify much more readily than either of these, but both will saponify—there is no question about that—although the proportion (or the partition) will vary with the alkali you use, whether it is potash or soda.

Suppose we acetylate these hydroxyl groups, then we can't guarantee that we shall get the same ratio of secondary acetyl to primary acetyl derivative. If we are going to assume that we have left two and one, you can see the wide variety of possible combinations and the practical impossibility of arriving at the same end-point.

Is that clear?

Mr. Herrmann—Yes.

H. Aronowsky—The professor made the statement that Cuprammonium process produces an expensive type of artificial silk. This, I believe, is due to the fact that no definite method has yet been devised for the recovery of the by-products, copper sulphate and ammonium sulphate, which are dissolved in sulphuric acid.

A plant was operated in Chester, Pa., about a year ago to produce Cuprammonium silk for consumption in this country, but the plant failed miserably because the product turned out to be entirely too expensive to compete with the other forms of artificial silk.

While a student at college, I worked for a year on the recovery of these by-products, and, before I did that I had to find out the solubility of copper and ammonium sulphate in sulphuric acid at varying temperatures. After working for about twelve hours a week for a whole year, I found four points or four solubilities, and the curves took such erratic jumps and leaps that the four points didn't mean anything.

In other words, to find the true direction of the solubility curve, perhaps sixteen to twenty points (somewhere around there) or half to a dozen points, will have to be found, and that may mean a matter of two or three years' conscientious work, so I gave the thing up.

I believe that that Cupramonnium process can be made a success, provided somebody can be found who can discover a cheap way of recovering the by-products of dissolving the cellulose in the Schweitzer's reagent and

then squirting it into the sulphuric acid to coagulate that.

Mr. Carter—You make a solution of cellulose acetate in acetone and you are going to prepare a transparent film. Now, it is usual to dry that above room temperature or say at about 100. If you let it dry at the ordinary temperature you get an opaque film which is not adhesive. If you dry above the room temperature, your film is quite transparent.

What is the reason for that?

Professor Hibbert—The reason is this: At ordinary temperatures you have an absorption or deposit of moisture and it is the water that gives you the opaque film.

Mr. Carter—Speaking of that Cuprammonium solution, I understand for some things, like coatings for window shades, the cotton solution has been made by putting copper in liquid ammonia and blowing air through until there is a sufficient copper content; I think they take it up to about one and a half per cent by the cyanide test. Would that be more suitable in making the ordinary Schweitzer's reagent?

Professor Hibbert—No, that is not the process employed to-day.

Mr. Carter—But in the coating of window shades—

Professor Hibbert—So far as I know it is the Viscose process which is generally employed.

Chairman Killheffer—I am sure we are all very greatly indebted to Professor Hibbert for this talk to us to-night. I also wish to acknowledge my indebtedness to our past Chairman, Mr. Wood, for having secured Professor Hibbert as our speaker for to-night. I am sure we all appreciate it greatly.

I would suggest that as a mark of appreciation we give the professor a rising vote of thanks.

. . . The meeting arose as a token of their appreciation for Professor Hibbert's talk.

. . . The meeting adjourned at ten o'clock. The attendance was about sixty.

FEBRUARY MEETING OF THE RHODE ISLAND SECTION

The February meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held in the rooms of the Providence Engineering Society, 44 Washington Street, Providence, R. I., on Friday evening, February 8, 1924, Chairman Ralph F. Culver, presiding.

The meeting was called to order at 8.15 p. m. by the Chairman, who called for the Secretary's report of the previous meeting to be read, as it contained the roster of officers for the year. The Secretary's report was accepted as read.

The Chairman then introduced Winthrop C. Durfee, Consulting Chemist of Boston, Mass., who addressed the members on the "Application of Chromium Compounds in Dyeing." (This paper is published in full herewith.) Mr. Durfee's address was received with considerable interest and appreciation which was shown by a rising vote of thanks.

The attendance was approximately fifty.

Respectfully submitted,

A. R. Fletcher, Secretary.

THE APPLICATION OF CHROMIUM COMPOUNDS IN DYEING*

By Winthrop C. Durfee

In considering the use of chromate compounds as mordants in wool dyeing, few new facts can be recited. The usual mordant on wool is some form or derivative of bichromate of soda or bichromate of potash. Bichromate of soda is probably a better material for use than bichromate of potash on account of its greater solubility in water. Bichromate of soda is a salt of sodium with chromic acid in which the proportion of sodium is only one-half the amount required to neutralize the acid. When we compare bichromates with other salts that are used as mordants, we find that these other salts have a metallic base combined with an acid in which the metallic base is the mordanting element and is present as a base in the salts used, while the chromium is the mordanting element of the chrome mordant. It is present as an acid in the salt used.

The attached table shows some of the salts used in mordanting wool and, with the exception of the bichromate, the mordant metal is on the base side.

The character and true color of the compounds of mordant colors with metallic bases is most clearly brought out in calico printing where acetate of chromium is used as a mordant, as whatever dye is not combined with the chromium base washes away and leaves the true color tone, whereas in wool dyeing a great many mordant dyes color wool as acid dyes. This strongly modifies the direct combination with the mordant, and the complete fixation of a mordant color on wool should be judged by its correspondence with the color it produces on cotton with the same mordant base.

Referring to the table, against bichromate of soda, sodium and hydrogen are on the side of the line devoted to metallic base, and chromium as chromic acid is on the side of the line devoted to acids, and the salt might be called hydrogen-sodium chromate.

Bichromate of soda formula is ordinarily written $Na_2Cr_2O_7 + H_2O$, but this might be rearranged and written $2NaHCrO_4 + H_2O$ and still be called bichromate of soda, or it can be written Na_2CrO_4, chromate of soda,

*A paper presented before the Rhode Island Section of the American Association of Textile Chemists and Colorists, February 8, 1924.

plus $H_2CrO_4 + H_2O$, chromic acid. The correspondence in form between $NaHCrO_4$, bichromate of soda, and $NaHSO_4$, bisulphate of soda, and the form Na_2CrO_4, chromate of soda, and Na_2SO_4, sulphate of soda, and the form H_2CrO_4, chromic acid, with the form H_2SO_4, sulphuric acid, shows at a glance, the acid character of chromium in the chromates.

Considering these chromium compounds—where the chromium is on the base side of the line—the chrome can be precipitated by alkalies, in the form of a gelatinous compound known as the hydrate. When the chromium is on the acid side of the line it can be neutralized from the bichromate to the chromate but is not precipitated.

The first question is why do we use bichromate of potash or soda where the chrome is on the acid side if we want chromium as a base to fix color in the fabric. The reason is that it is an acid, and wool fiber absorbs acid energetically. The obstacle to the use of salts where chrome exists as a base is that the wool will take the acid from these salts in preference to the chromium base and have the same effect upon them as a weak alkali, the acid being absorbed into the wool and the chromium precipitated as a gelatinous hydrate not in the wool, but upon any surface with which it comes in contact, mainly, of course, the wool itself, but giving no penetration and developing unevenness and crock.

Organic acids of the class to which oxalic acid and tartaric acids belong, do not let go their grip of the chromium base in the same manner that the mineral acids do, and if these organic acids are absorbed into the wool fiber, they take the metallic base with them. They seem to have a power of control which an equivalent amount of acidity in the mineral acids does not possess. This may be illustrated by an experiment. When ammonia is added to the salts of chromium, alumina or iron and mineral acids, the metallic base is precipitated as a hydrate, while when added to the solution of chromium, oxalates or tartrates, it does not precipitate. It is believed by some that wool-substance is an organic relative of ammonia, and this experiment illustrates to some extent the action of the wool-substance itself.

Bichromate, because furnishing chrome in the acid form, is of great value in the control of penetration and evenness of the chromium compound in the wool fiber, but the developed color is a combination of the dye acting as an acid with the chromium as a metallic base. Between these two operations the character of the chromium must be reversed chemically, principally within the wool fiber, without injury to that fiber.

Chromium as an acid differs from chromium as a base in the quantity of oxygen which it carries. The fixation of the chromium in the wool as an acid and the subtraction of the excess oxygen constitutes the mordanting process when properly performed.

The energy of the action that must take place within the wool fiber can be illustrated by heating the edge of a mixture of bichromate and sugar until it takes fire and noting the resultant burning of the whole mass; the ash is olive green—a change from the orange color of the chrome. By whatever process it may be accomplished, the change of a chromate to a basic form of chrome is the burning up of some material by the excess oxygen. When mordanting with chromates, the material burned or destroyed must be derived from the

SALTS USED AS MORDANTS

FORMULA	NAME	METAL BASE	ACID
$Al_2(SO_4)_3$	Aluminum Sulphate	Aluminum	Sulphuric (H_2SO_4)
$Cr_2(SO_4)_3$	Chromium Sulphate	Chromium	Sulphuric (H_2SO_4)
$Fe_2(SO_4)_3$	Ferric Sulphate	Iron	Sulphuric (H_2SO_4)
$Al(C_2H_3O_2)_3$	Aluminum Acetate	Aluminum	Acetic ($HC_2H_3O_2$)
$Cr(C_2H_3O_2)_3$	Chromium Acetate	Chromium	Acetic ($HC_2H_3O_2$)
$Fe(C_2H_3O_2)_3$	Ferric Acetate	Iron	Acetic ($HC_2H_3O_2$)
$Na_2Cr_2O_7 + 2H_2O$ or $2NaHCrO_4 + H_2O$	Sodium Bichromate	Sodium and Hydrogen	Chromic (H_2CrO_4)
$Al_2(C_2O_4)_3$	Aluminum Oxalate	Aluminum	Oxalic ($H_2C_2O_4$)
$Cr_2(C_2O_4)_3$	Chromium Oxalate	Chromium	Oxalic ($H_2C_2O_4$)
$Fe_2(C_2O_4)_3$	Ferric Oxalate	Iron	Oxalic ($H_2C_2O_4$)
$Al_2(C_4H_4O_6)_3$	Aluminum Tartrate	Aluminum	Tartaric ($H_2C_4H_4O_6$)
$Cr_2(C_4H_4O_6)_3$	Chromium Tartrate	Chromium	Tartaric ($H_2C_4H_4O_6$)
$Fe_2(C_4H_4O_6)_3$	Ferric Tartrate	Iron	Tartaric ($H_2C_4H_4O_6$)
$Al_2(C_{14}H_6O_6)_3$	Aluminum Alizarate	Aluminum	Alizarine ($H_2C_{14}H_6O_4$)
$Cr_2(C_{14}H_6O_6)_3$	Chromium Alizarate	Chromium	Alizarine ($H_2C_{14}H_6O_4$)
$Fe_2(C_{14}H_6O_6)_3$	Ferric Alizarate	Iron	Alizarine ($H_2C_{14}H_6O_4$)
$H_2CrC_4H_2O_6$	Chromo-Tartaric Acid	Hydrogen (H_2)	Chromo-Tartaric ($CrC_4H_2O_6$)
$H_2Cr(C_2O_4)_2$	Chromo-Oxalic Acid	Hydrogen (H_2)	Chromo-Oxalic (CrC_4O_8)

wool, the dyestuff or some material intentionally used for the purpose. If from the wool this material would be the natural sulphur contained in the wool. This sulphur has a close relation to the elasticity of the fiber and should not be destroyed. If from the dye, the oxygen may change the nature of the dye. The safe plan is to associate with the chromate material which will take up oxygen more readily than the sulphur of the wool and leave the chromium in the wool without any surplus oxygen that can affect the dye. The quantity of chromium which is generally absorbed into the wool fiber is greater than the amount necessary to form the true combination with the dye used, and the condition of the chromium is an important element of its efficiency.

In practice, this change of condition of the chrome is incomplete; much unchanged chromic acid is absorbed into the wool as in a sponge.

In processes of dyeing in vogue thirty or forty years ago where dyewoods were largely used, this absorption of unchanged chromic acid into the fiber was a benefit, particularly in the case of logwood, where the oxygen of the chromic acid developed the coloring matter of the logwood to a higher efficiency and, conversely, the logwood had other properties which caused it to act as an organic acid and to some extent function the same way as oxalic or tartaric acid, and thus complete the mordanting process in the dye bath, at the same time increasing the efficiency of the dye. This effect of dyewoods led to great confusion as to the best methods of mordanting wool and the proportions of organic acids to be used, particularly for highly developed alizarine or anthracene colors which do not favorably withstand oxidation. The increased use of alizarine or anthracene colors following the demand for extreme fastness to light necessitates a rearrangement of formulas for mordanting wool.

The alizarine or anthracene colors are definite compounds that come to the dyer in a nearly pure state, and the chromium base should be present in the fiber in a condition to readily combine with these compounds, considered as organic acids.

All acids and bases combine in exact proportions. The fixation of mordant dyes in a fiber is combining them with definite amounts of chromium in that fiber. More chromium than is needed may be harmful, as the color tends to combine with the first chromium it reaches. The penetration of the color may be arrested near the surface of the fiber, if it comes in contact there with sufficient chromium base to form its compound, and proceed no further.

There is sometimes advantage in too little chromium for the full compound, as the tone of color required may not be that produced by the complete union of the dye with the full amount of chromium it is capable of taking on.

Certain alizarine blues lose their violet tone or "bloom" by prolonged boiling on a heavy mordant. The best practice would be to mordant with reference to the quantity of dyestuff which it is intended to use. We must remove from our minds any idea that the greater the quantity of chrome the better the fixation.

In ordinary practice more chrome is used than required for the dye. As the chrome is not perfectly reduced, there is in the fiber some unchanged chromic acid which does not combine with the dye and it is not removed by washing or neutralization. This is the main cause of fading of otherwise fast dyestuffs when the fabrics are exposed to light.

It is difficult to determine the amount of chromate which should be used with reference to a definite quantity of a dye. It may be extraordinarily difficult to distribute a small amount of chromium evenly throughout the fiber. Again, it may be necessary to put more chromium in to the wool than the dye needs in order to attract the dye away from the wool substance, because many of the dyes now used as mordant colors also combine with the wool. Where there is a small amount of chrome in proportion to the wool, that wool may hold the dye strongly enough to slow up the process of fixation by the chrome beyond the time limit of practice.

Most mordant colors act as acid dyestuffs having a level dyeing character. Where there is only enough chrome in the wool to form the compound with the color, a boiling off and on action would take a long time before all of the color came in contact with all of the chrome. About one-fifth of 1 per cent bichromate might contain all the chromium necessary to unite with a given quantity of a dye. In practice, about 1 per cent of bichromate should be used in order that the fiber may present sufficient chrome to the dyestuff within the limits of time available for the dyeing.

In this case it would seem that 3 per cent of chrome would give about fifteen times as much chrome as the color required and the proper amount of mordant be between the one-fifth of 1 per cent needed and the usual 3 per cent, which is fifteen times as much as needed.

The quantity of bichromate to be used is the minimum that will bring about the development of the dye within the given time. The practical difficulty in fixing small amounts of chrome is to obtain even distribution and penetration, as the tendency is for the chrome to fix itself on the first wool substance it strikes and be tenaciously held.

If little chrome is used it has a tendency to go on the outside of the fiber unevenly, or if evenly on the

surface of the fiber, there it attracts the color too quickly so that the color also tends to go on unevenly. On the other hand, if we use plenty of chrome the color finds chrome near the surface and will combine quickly and therefore unevenly and without penetration.

The best method is to use the practical minimum of bichromate for the color and apply it in such a manner that the wool will be thoroughly penetrated. The attraction of the chromate for the wool fiber must be retarded rather than assisted; the solubility of the chrome under any change of condition must be maintained. The chrome must always have nearly as great a tendency to remain dissolved in the mordant bath as to fix itself on the wool, which is a necessary condition for penetration and evenness.

The substance used to alter the chrome from the acid condition must produce a soluble compound of chromium which will not become decomposed by the attraction the wool has for acids, or it must carry sufficient excess acid to satisfy the attraction of the wool for acids.

When a small amount of chrome is used, the acid must be in large proportion to the chrome because of the tendency of the wool to absorb acids.

The salts of chromium with organic acids not being decomposed of wool fill the first requirement, and the organic acids themselves, being acids, the second. The organic acid salt of chromium is absorbed into the wool in much the same manner as a free acid.

As to the use of a large proportion of organic acid with small amounts of chrome, in addition to its primary function of satisfying the attraction of the wool for acids, there is another advantage of even distribution and penetration. The large quantity of acid dilutes the chromium salt in the general mass of acid which is absorbed. As illustration: If a dry sponge is made to absorb a few spoonsful of concentrated sugar syrup, this syrup would stick to the sponge at the first points of contact, but if the syrup was diluted with just sufficient water to thoroughly wet the sponge, then the whole mass would wet the sponge throughout and the sugar syrup would be distributed throughout the whole mass of sponge substance and, after drying, it would be found to be evenly distributed.

As to penetration and levelness, where 3 per cent of chrome is used, the chrome will generally level itself throughout the fiber. Where small amounts of chrome are used, large amounts of organic acid are necessary to control its distribution. With the usual mordant of 3 per cent chrome and 3 per cent tartar, the proportion is equal, but where only 1 per cent of chrome is used, the tartar should be increased from 5 to 7 per cent, or seven times as much tartar as chrome.

Where very brilliant dyeing is desired with mordant colors, the higher ratios of tartar can be used with the full 3 per cent of chrome. This was pointed out by Professor Humell some thirty years ago, who then recommended 15 to 20 per cent of tartar and 3 per cent of chrome for the best results. What was actually taking place in the mordanting process was little understood. It is only very recently that careful study of the phenomena of mordanting has indicated that the control of mordants must be based upon the tendency of the wool to absorb acids.

Aside from the quantity of chrome in the fiber, the energy of the chrome in combining with dyes is important. If simply precipitated in or on the fiber as a hydrate, the affinity of the hydrate for dyes is weak. If absorbed into the fiber combined with strong material acids such as the chlorides, the acid retains such strong hold on the chromium that it will not release it to the dye (dyes can be regarded as weak organic acids), but if the chrome is combined with a weak organic acid in the form of a soluble compound, it is in a condition to make a less soluble compound with the dye, or a color lake. It is due to this fact that the tartrates are valuable in mordanting. Aside from their power to absorb oxygen from the chromates, they form soluble salts in the fiber, and the tartaric radical of the chrome tartrates is a weak acid standing low down on the scale of energy as applied to acids and readily surrenders its chromium base to the stronger acid used as a dye.

To sum up: Chromium must be fixed on the fiber from bichromate solutions in which the chromium exists as an acid by associating it with an organic acid which has the property of absorbing oxygen from the chromate and changing the chromium to the basic form. This acid must be one whose salts are soluble and which will not be broken up by the attraction of the wool substance for acids, and must enter the wool without decomposition. The acid must not be able to withhold chromium from other organic acids (dyes) which are capable of forming color lakes.

Oxalic acid is a somewhat stronger acid than the tartaric acid, and the tone of color produced with Alizarine Red on goods that are mordanted with bichromate associated with salts of tartaric acid, illustrates the relative strength of acid and the advantage of use of the weaker one. In the case of the oxalic acid chrome mordanting, the Alizarine Red produced has a salmon or yellowish overhand, and in the case of chrome mordanting with the tartars the Alizarine Red has a bluish or a pink overhand. This difference is probably due to the difference of energy in the two acids.

The Alizarine Red, regarded as an acid, does not take the chromium completely from the oxalic mordanting compound and shows the yellowish tone of the alizarine,

whereas the tartrate releases the chromium completely to the alizarine and the product is Carmine Red, indicating the complete union of alizarine with chromium.

No formulas have been given because it is the intent of this paper to suggest to the experienced men simply theoretical consideration of the mordanting process.

APPLICATIONS FOR MEMBERSHIP

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Newsome, J. M., 14568 Superior Road, Cleveland Heights, Ohio.

Tew, Arnold G., 232 East Pearl Street, Cincinnati, Ohio.

ASSOCIATION BADGES

Those who attended the Annual Meeting of Providence had an opportunity to examine and purchase the new lapel button badges which were there distributed by the Secretary.

For the benefit of members who were unable to attend the meeting an illustration of the badge is shown herewith.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

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April 7, 1924

CO-OPERATIVE TEXTILE RESEARCH

IN 1912-13 the American textile industry was rapidly approaching a crisis. Foreign competition was keener than it had ever been before. The relatively good business of the two previous decades had resulted in considerable overexpansion, and some of the ablest men of the industry were greatly concerned as to its future. Then out of a clear sky came the war. The period of unprecedented military demands created a world-wide shortage of material for civilian reqquirements, and this, combined with circumstances which were even more effective than an unlimited protective tariff, resulted in the greatest prosperity the industry had ever experienced.

All this is past however. Conditions are approaching more nearly the pre-war normality, and foreign competition again looms on the horizon as a bogy to be reckoned with. This means that America—if she would maintain anything like supremacy in the markets of the world, as well as hold her own business against foreign invasion—must manufacture not only the best goods but manufacture them at a minimum cost. Furthermore, she must become a leader in the introduction of novelties and attractive designs rather than a follower and an imitator. There are a number of fundamental considerations which must not be overlooked if this much-desired situation would be obtained, but it is our intention at this time to mention but one, namely, co-operative research.

For a number of years the proceedings of nearly every meeting of the various textile manufacturing associations have brought out in one way or another the advisability of supporting research work either in their particular line or for the general good of the industry. In some instances, whole days have been devoted to symposiums upon the various phases of research work and its desirability. But from all this few, if any, tangible results are as yet to be observed, and it must be admitted that the United States is far behind a number of foreign countries in respect to research work along the line of textile chemistry and dyestuff application, as well as in the purely mechanical side of textile manufacturing.

In this connection one might appropriately recall the remark of one of the world's most aggressive generals. Taken to task by some of his associates as they looked over the field of carnage, he said, "You cannot make an omelet without breaking a few eggs." Just so with research work. You can make no headway without spending large sums of money, and the textile manufacturers of the country, taken as a group, have been loath to do this. They sometimes appoint committees to find out what has already been done, but seldom do the records show that they have appropriated money for actual research work. They forget that real work of this character requires equipment and high-grade scientific workers devoting almost unlimited time to its development, and that both of these require dollars. Furthermore, they all too frequently endeavor to measure the value of research work by purely visible standards. Research work, owing to its fundamental nature, is necessarily an adventure into the realm of the unknown, and because it cannot always lead rapidly to results expressed in terms of actual profit it does not appeal to them. Manufacturers overlook the fact that negative results often have a decidedly measurable value. Frequently a relatively small amount expended in research and investigation might have convinced them that some of their contemplated projects were impracticable and they would have thereby been saved thousands of dollars.

So much for the diagnosis. Now a few words as to the remedy. If it were necessary to express this in one word that word would be *"funds"* The question immediately arises: Where should such funds originate? Most certainly with the textile industry, and not as a philanthropy but as an investment or a legitimate expenditure under the heading of promotion work.

We may reasonably take the total of the finished textile products of the United States for one year at three billion five hundred million dollars. If one cent of every $50, or in other words, $1.00 out of every $5,000 of sales was devoted to research work, it would be sufficient to make the United States within five years the leader in co-operative textile research and do more toward maintaining America's supremacy in textile manufacturing than an equivalent amount of money spent in any other way. Of course, it could not be expected that the industry would come in on such a proposition 100 per cent strong, but, assuming that only 50 per cent responded, the amount appropriated would then be three hundred and fifty thousand dollars annually.

The textile manufacturer may justly inquire as to what constitutes co-operative research and how funds for its development should be administered. It is, of course, beyond the scope of this editorial to formulate a complete working plan for such an undertaking. In fact, its final form of administration should be the development of many minds and not one. However, certain fundamentals may be stated.

Successful and efficient co-operative research involves two things: First, a number of well supported and active

research agencies and, second, an officially recognized and representative board who, through their executive officers, shall co-ordinate the work of these different agencies and see that the available funds are equitably distributed for the accomplishment of the greatest good.

To illustrate what is meant by active working agencies we shall mention those with which we are most familiar, namely, the American Association of Textile Chemists and Colorists, the Philadelphia and Lowell Textile Schools, the Bureau of Standards, and the Textile Committee of the Society of Testing Materials.

The American Association of Textile Chemists and Colorists have a well organized research committee of twenty or more members, among whom are the leading scientists and technical men of the industry, and, as a group, they are undoubtedly capable of directing research work of a highly practical character. The laboratories of the institutions mentioned stand ready to provide as complete an equipment for this type of work as there is in the country, and in some instances have formulated extensive plans for such work, but have no funds with which to carry them out.

Is not such a project worthy of the thought and support of our American textile industries, not as a philanthropic venture but as a co-operative promotion of their own interests?

T. C.'S COLUMN

DYESTUFF SAMPLES—USES AND ABUSES

The question of proper distribution of dye product samples and of their proper use by the consumer is not as small a matter as it might seem. The producer's point of view was presented some months ago in The Reporter. The consumer also should have something to say, for actually the expense of filing and testing an average assortment of dye samples is much greater than the cost of sending them out.

Product samples are one of the necessities of the trade, and the well-organized laboratory or dyehouse looks with pride on its well-stocked shelves of types. Nothing else can take their place, and they are worth all the time and trouble that it costs the seller to prepare and send them or the user to keep them on file with proper records.

As to testing, that is not always an issue. Often such samples are merely held ready for a future need, and there may be no occasion to test them until some special use arises. In other mills all the samples may be live products, each with a record, and subject to use at any time. New ones that are real types are added and tested as fast as they appear, and while the producer may not always be satisfied with the decisions he know that his goods are having fair treatment. Any up-to-date chemist or dyer wishes to be familiar with new products; but if the seller submits a proper description with each, some one property may offset all the good points, and testing for the particular purpose in view becomes a waste of time. Other dyers are not only worth a laboratory test but appear at once worth trying on a practical lot of goods. It is true, too, that a laboratory test is often quite insufficient.

On giving the general question a little thought several other quite distinct cases appear. A user may write for dyes for some special properties or for competition. One who asks for dyes should feel under obligation to give them proper consideration, which will often include dyeing a sample. However, making such a sample dyeing is an expense, and if the price or known properties of the dye eliminate it from competition or use the user is certainly freed from any obligation whatever, although he may wish to have a sample dyeing for a record.

In their own interest it is often wise for dye firms to send out samples on inquiries even when they are not requested. If the user happens to want a little of the dye he has it without waiting two or three days, an advantage to both parties. The seller, however, cannot *expect* all such samples to be tested.

A salesman often wants to get his line before a dyer, and among his advertising material includes a line of product samples. Does this put the dyer under obligation to test them? Not at all. He may be foolish not to do it, but that is for him to decide. It is hard to see where dye samples should command any more respect than other advertising matter.

There is a type of dye firm that is really a worse offender than any user—one that may or may not make a few dyes but handles a complete line, and will furnish samples by the wholesale on the slightest provocation. The dyes may come from a variety of sources, are therefore likely not to run uniform, and can usually be bought to better advantage from actual manufacturers. Many of them are common, everyday types, perhaps with strange names and without even price to recommend them. Testing most of such samples is a waste of time.

Like so many other vexing questions, the whole thing simmers down to the application of common sense, the use of moderation in sending out samples, because the average busy consumer does not have any too much time for testing, and reasonableness in testing out dyes, especially if the seller has gone to some trouble in selecting and sending them. It is best not to ask for samples or to encourage the sending of them unless they are really wanted. It is also well to keep in mind that the man who tests and uses a new color may profit far more than the man who sells it.

There is one more application of common sense that we have not touched at all: Who in the end is responsible if the mill or dyehouse does not give the materials on the market proper consideration, and use those that are best for its purposes? No one but the management, which should be enlightened enough to see that they get the best as fast as it is offered. If it cannot reasonably be expected from their busy dyer, then there is an opportunity for a laboratory and chemist. T. C.

PRACTICAL HINTS ON THE PRODUCTION OF BRIGHT COLORS ON TEXTILE FABRICS

(*Continued from page* 218)

produced, through an iron rod working on a revolving iron disk moved by an arrangement of pinion wheels running in contact with the last pair of squeeze rollers.

So that the cloth is submitted to the same tension throughout, all pairs of squeeze rollers are of the same size and are turned for the same interval by a series of special pinion wheels pinned to the shaft of the lowest rollers and revolved by endless worms fitted to a long iron shaft worked at the back of the plant by an endless chain driven, in turn, through a small electric motor or through other convenient means.

The Working of the Plant

The working of this plant requires care and practice if it is to be conducted as economically as possible. The dyer's first operation is usually to enter an old piece of cotton cloth or a piece to be dyed later in black or dark colors, causing this to run on all guide rollers and between every pair of the squeeze cylinders G, H, I, L, M, O, and having one end entered in the leading-in arrangement P and the other end through the plaiting mechanism R.

When this operation has been accomplished in the empty vats, these are filled with the respective baths. The plant is put in motion to draw through the material, which is thus first treated with a weak soda bath in the first vat and then led into a soap or soap and phosphate of soda bath containing the dye. In the second vat a good portion of the coloring takes place and is terminated in the bath that follows. On entering the three rinsing waters the material is freed of all fugitive color and of the greater part of the soap and other ingredients it may contain.

The Advantages of the Plant

The advantages of this plant are several, and may be enumerated as follows:

1. The plant costs less than the open soaper described previously, and is also of more simple construction.

2. The cotton cloth running through the different baths is submitted to a larger number of squeezing operations than with the open soaping, resulting in a more thorough treatment and better utilization of the dye.

3. The cotton cloth is wet out before the dyeing operations, simplifying the production of the brightest shade.

4. A more thorough rinsing takes place than on the open soaper.

5. The machine can also be employed for dyeing dull shades by the ordinary processes.

6. Through the possibility of treating with two independent dye baths, one bath can be employed for the preparation of a ground and the other for the covering of this, compound shades being thus produced in two baths and not in one, as is usually the case.

7. Because two dye baths are used, one may contain salt and the other not; that is, one may form the shade and the other brighten it.

Defect of the Plant

The above plant has one serious defect that should be pointed out: Each time a new batch of material is to be dyed it is necessary to pass through the dye bath either a full piece of cotton cloth or one or two cotton tapes. These take up a portion of the dye, resulting in a certain loss. For this reason it would pay machinery manufacturers to study a means for introducing the material to be treated without any wetting out of the introductory piece or tape. A continuous dyeing machine with such a feature could be constructed on the principle shown in Fig. 2.

This is composed of a long vat, divided into six sections, made of the most suitable material for preventing the formation of rust and corrosion. All divisions (A, B, C, D, E, F) have a double perforated bottom which, in the case of the second, third and fourth compartments, covers a convenient heating means and has a certain number of guide rollers (a, b, c, d, e, f) that, through a special disposition in the plant, can assume

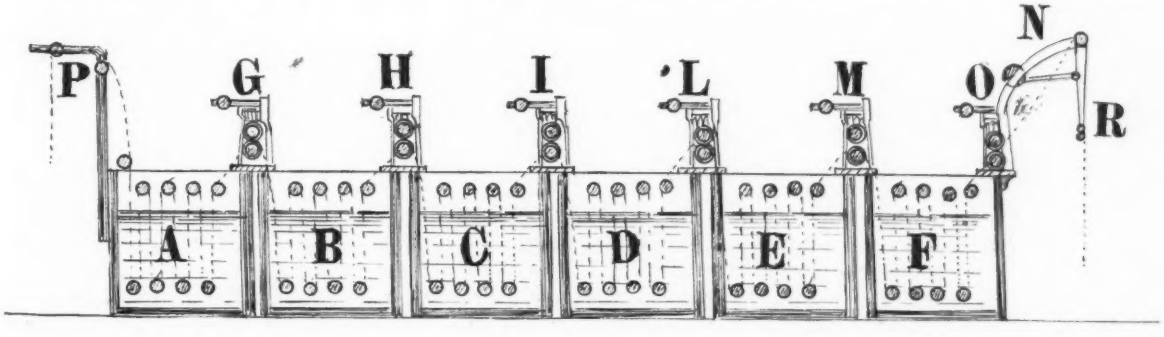


Fig. 1

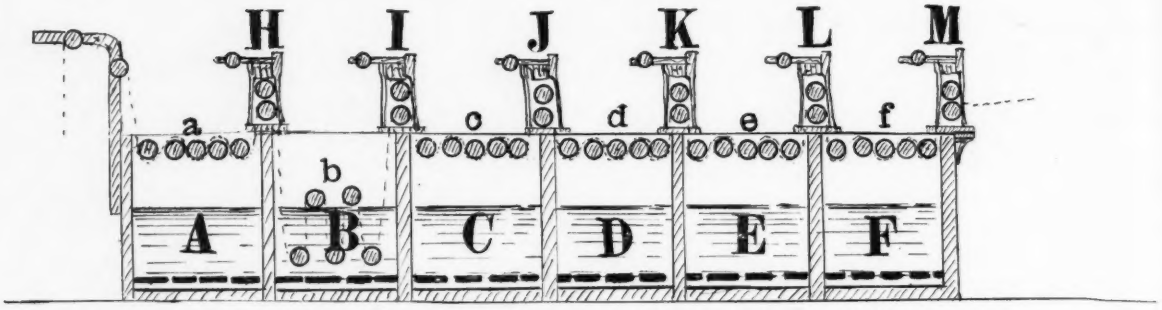


FIG. 2

two different positions; that is, they can remain all in line at a certain height above the bath of treatment, as shown in the case of A, C, D, E, F, or can be lowered slowly and at regulated intervals one by one, assuming the position shown in B.

At the end of each compartment is a pair of squeeze rollers, indicated in the figure by H, I, J, K, L, M. As the turning of the guide and squeeze rollers during the lowering of the guide rollers from the highest to the lowest position should take place more slowly than when all such rollers are in this last position, the plant is supplied with a special driving means that regulates the work on the plant to keep it in each dye bath the same length of time.

THE WORKING OF THE PLANT

The working of the above plant would be as follows: A long piece of cotton cloth is introduced on all guide rollers a, b, c, d, e, f, kept in a horizontal line, and between the intermediate pairs of squeeze cylinders H, I, J, K, L, M. When this has been accomplished, the dyer sews to the end of this piece the beginning of the first piece of cotton cloth to be dyed and enters the different baths in the compartments A, B, C, D, E, F, putting the plant in motion. The pairs of squeeze rollers H, I, J, K, L, M are thus turned slowly and drag forward the cloth, while the guide rollers descend one by one as the waste piece of cotton cloth has left them, arriving in time to bring the beginning of the material into the bath and only slightly wetting the end of the waste piece. As the driving operations proceed, a second guide roller follows the first, not going, however, as low as this last, and is followed after a certain interval by a third and in close succession by a fourth and a fifth roller, the wet material then reaching the first pair of squeeze rollers H, the turning of which is regulated automatically so as not to hinder in any way the passage of the piece being treated or to cause an excessive tension on the cloth. In the second compartment the same operation takes place.

After it has run through a certain portion of the bath the speed is gradually increased to avoid too long a submersion in the bath, and consequently too strong coloring of the fabric. When the cloth passes through rollers J at the end of the second dyeing compartment (C), the full speed at which the machine is to be run is reached. This is then maintained to the end of the dyeing operations.

When the end of the last piece to be dyed has nearly been reached, the operators move a lever on the machine and sew to this end the beginning of the waste piece introduced at first. This is then carried again over the guide rollers, which now rise out of the bath one by one, not letting the waste cloth become wet in any way except with what bath is left on them, which causes only a very slight coloring. In this way, by the time the cloth reaches the end of the wetting-out, dyeing and rinsing plant all guide rollers have been raised and the plant is ready for the treatment of a second lot, after the operators have withdrawn the baths in the different vats, substituting them with fresh baths.

The plant described above offers a certain number of advantages besides that of avoiding the coloring of the introductory cloth or tapes, and some of these are as follows:

1. The same entering fabric or tapes can be employed repeatedly, or any of the pieces to be dyed later can be used, changing these each time, without causing much difference in the shades produced on them later.

2. The colors used in vats B and C can be changed while the plant still contains the tape.

3. When the plant is working correctly, the operators seldom need to enter the guiding fabrics or tapes around the guide rollers and through the pairs of squeeze cylinders, because by sewing these to the ends of the last pieces being dyed each time they are dragged through at once into position.

There is no doubt that a great number of bright shades could be dyed with weak solutions of the direct dyestuffs or with exhausted baths if only the principle were adopted to continually impregnate the cotton goods with the dyestuff, submitting it to an intermediate drying process. In this way the cloth would be supplied with several very thin coatings, resulting in

just as fine effects as when strong baths are used leaving out the supplementary dryings.

If continuous plants are employed, using several compartments for the dyeing, the above method can be reached by passing the cloth as it comes from each compartment onto an independent series of upright drying cylinders placed on an upper landing. This method uses considerable space, labor and power, and is not economical of dye. This may cause the process to be too expensive. By employing a plant constructed on the principle indicated in Fig. 3 the new process can be rendered practical.

This shows a large, high, rectangular iron case (Z) having three compartments (1, 2, 3), the first of which serves principally for the dyeing and drying operations, while the second (2) only dries the material and the third (3) is really a secluded chamber, closed off by a perforated ceiling which collects the hot air produced through a multi-tubular heater (H) and blowing fan (X) and allows it to pass upward into all portions of the plant simultaneously.

The operators have access to the first story from an upper landing (P). This contains seven dyeing vats (A, B, C, D, E, F, G), which are supplied with the necessary tubes and taps for allowing their being used in different ways for the dyeing of the cotton cloth (c), run through in full width. These vats are joined together by strong iron bars so arranged as to leave a large opening between them, serving for the passage of the material during its run through the plant. This story also contains several series of glass, enameled iron or copper-plated iron guiding rollers (m, m, m, m, m), serving for the raising of the cloth, entering in the first dye vat from roller o.

Compartment 2 contains several series of lower and upper guiding rollers (I, J, K, L, M, N and Q, R, S, T, U, V) serving to keep the color cotton cloth coming from above in continual contact with the hot air coming up from below. Compartment 3 has simply a powerful fan (X) driven by an electric motor, which sends the air from outside through a multitubular heater (H).

To keep as much of the hot air as possible in the upper chamber (1), this is closed at the points of entrance and exit of the cloth, whereas for giving the air itself the desired direction and withdrawing all moisture formed a ventilator is placed in the middle of the ceiling. All three compartments contain doors, closing tightly, through which the workpeople can enter the plant to accomplish all cleaning operations; suitably placed windows allow a view of the interior during the working operations.

The above plant can be worked in different ways in accordance with the dye baths employed and the nature and quantity of material to be treated. One way of working it would be as follows: After having passed a very long tape through the entire plant, running it over all rollers inside or outside of the dyeing vats, the operators prepare in a vat at the back or top of the plant the dye bath that is to serve for the treatment of the batch of cotton cloth, utilizing an old bath containing no salt, by mixing with it a reduced quantity of the direct colors that are necessary for producing a given shade, and bringing it to a fixed volume, which is made to vary in accordance with the weight of the fabrics to be dyed, their speed of running through the plant, etc. When this has been accomplished, they sew to the end of the tape the beginning of the first piece to be dyed and put in motion the mechanism driving the plant.

The cloth is thus carried rapidly into the first vat (A), taking up with it more than its weight of dye bath, and on passing over the first series of guide rollers runs downward into compartment 2 to the next series of guide rollers indicated by I, and continues, after this, between these rollers, the upper m rollers and the series Q, rising from these last into the second dye vat in a dry condition, having fixed on its surface

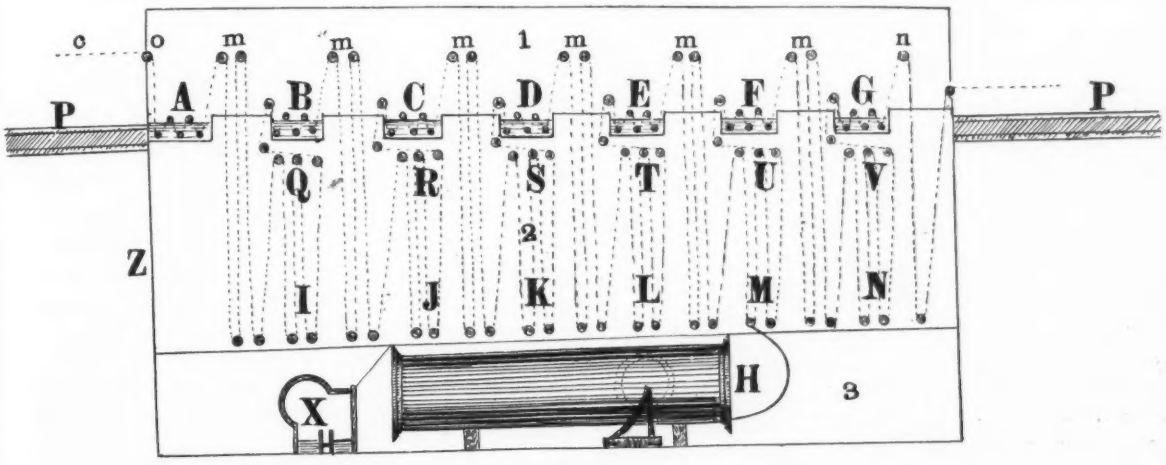


FIG. 3

a small amount of the dye. Here the material is wetted out a second time and mounts on the second series of m rollers, descends to the rollers J and passes between these two sets of rollers and those indicated by R, rising later into the third dye vat C.

In this, the cloth which has been twice dried takes up a third covering of dyestuff, already becoming deeper in color, and is again dried on the third series of rollers m and on the rollers K and S, and is carried into the fourth dye vat (D), receiving a fourth layer of dye, followed by a fifth, sixth and seventh coating, by a rapid passage through the vats E, F and G, and intermediate drying on the fourth, fifth and sixth series of rollers m and on the rollers of the series L, T, M, U, N, V. On leaving vat G the material has received its full dyeing treatment and is given a final drying on a series of upper and lower rollers, following that indicated by n, and not indicated in the figure, so that on coming out of the plant it is thoroughly dry and ready for the calender.

The Advantages of the Plant

The above plant has many advantages that lower the cost of dyeing, permitting the production of cheaper fabrics. Some of the advantages can be enumerated as follows:

1. Through constructing troughs A, B, C, D, E, F, G of little depth it is possible to decrease the amount of dye only to what is necessary for the wetting of the material, thus preventing considerable waste.

2. The heat produced by the fan X and heater H not only warms the compartments (1 and 2) just above but also the dye vats, the baths of which thus penetrate to a greater degree the innermost cells of the cotton fabrics, making possible the production of evenly dyed goods.

3. The continual drying of the material, which is made to follow every impregnation in the dye bath, causes the evaporation of a considerable portion of water from the bath. It is possible to regulate the flow of water so that it is sufficient to fill the vats, preventing any from running out into the waste water main or into the storage tank. The bath left after the dyeing is reduced in this way to just what remains in the dye vats and in the tubes leading to or from these.

4. Through special tubes and taps on the seven dye vats and the necessary number of solution troughs annexed to the plant, this can be differently employed, it being possible to treat the cotton cloth with only one dye bath which is caused to run through all dye vats or to treat it with any number of separate dye baths.

5. When treating the cotton cloth with seven different dye baths, these can be used for seven different colors, and after some practice it is possible for the dyer to compose his shades and colors by regulating the quantities and strength of the dye bath used in each case, forming a proportion table based on treating always at the same speed, whereas by introducing an intermediate tape at the end of a batch treated in one color and shade and emptying the vats and entering new solutions it is possible to begin the treatment of a new batch in a new color without stopping the plant.

6. The operators can watch all dyeing operations and can take samples by stopping the plant momentarily and restarting it at once, correcting any poor shade.

7. The work of the plant is not difficult, and painstaking operators can increase its advantages, obtaining results not possible on many of the other plants in use at present.

8. Should it be required to conduct a soaping, this can take place in vat F, using vat G for rinsing purposes.

(To be continued)

"A DYEING PROBLEM AND HOW I SOLVED IT"

The number of requests for accurate information about dyes and dyeing that come to the office of the publishers of The Reporter lead them to believe that a series of short articles run under the above heading would prove of practical value to every dyer. That problems arise continually in the dyehouse we know; that such problems are very often solved by the ingenuity or the experience or the "book-knowledge" of some dyer, we also feel sure. To obtain, first hand, a description of these problems and, what is most important, a clear explanation of how they were solved, written by practical men in practical dyers' terms, we are going directly to the dyers themselves

We will pay $5.00 for every letter we receive which we judge suitable for publication. In judging contributions, literary merit, of course, will not be considered, as we shall properly edit them for publication. Simply tell how your particular problem was encountered, the nature of the dyeing, or the bleaching or finishing process that you were using at the time, the kind of fabric upon which the trouble showed, and any other necessary details. Then briefly describe the steps you took to overcome the defect and what final conclusion you arrived at, that is, what facts or information did you discover that was "new to you.'

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered.]

CROCEIN ORANGE
(Schultz No. 37)

COMPOSITION: Mono azo type.

SPECIALLY SUITABLE FOR: Wool and silk.

USUAL METHOD OF DYEING: On wool with Glauber salt and sulphuric or neutral. On silk in a boiled-off liquor broken with sulphuric.

SHADE: Red; shade orange.

SOLUBILITY: Good.

LEVEL: Good in medium and heavy shades.

EXHAUSTS: Well.

FASTNESS TO:
- **Acid:** Good.
- **Alkali:** Not fast.
- **Carbonizing:** Satisfactory.
- **Fulling:** Poor; bleeds badly
- **Light:** Fast enough for ladies' dress goods; not suitable for men's wear.
- **Potting:** Very poor.
- **Rubbing:** Excellent.
- **Steaming:** No change in shade on steaming at 14 pounds.
- **Sulphur:** **Slightly lighter shade;** bleeds somewhat.
- **Washing:** Poor.
- **Water:** Poor; markischer test bleeds badly.

ON UNIONS: Wool-silk—suitable; both fibers dyed the same shade. Cotton-wool—not as well adapted.

ON OTHER MATERIALS:
Cotton-effect threads are stained.
- **Jute:** Suitable in neutral Glauber salt bath.
- **Pigments:** Suitable.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dye & Chemical Works (Selling Agents, John Campbell & Co.); Cincinnati Chemical Works; National Aniline & Chemical Con.pany; Sherwin-Williams Company.

ORANGE G
(Schultz No. 38)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric.

SHADE: Orange.

SOLUBILITY: Good.

LEVEL: Good.

EXHAUSTS: Slowly.

PENETRATION: Excellent.

FASTNESS TO:
- **Acid:** Good.
- **Alkali:** Not fast.
- **Carbonizing:** Satisfactory.
- **Fulling:** Shade goes lighter; bleeds badly.
- **Ironing:** Fair; shade changes, but returns on cooling.
- **Light:** Best of the acid oranges; better than Orange II (S-145).
- **Potting:** Not fast.
- **Rubbing:** Good.
- **Steaming:** Good.
- **Street Dirt:** Fair.
- **Sulphur:** Fair.
- **Washing:** Not fast; bleeds off badly.
- **Water:** Not fast.

OTHER PROPERTIES: Not suitable for any goods that are washed after dyeing.

ON UNIONS: Wool-silk—with acetic acid the silk is only slightly stained. Cotton-wool—dyed acid, the cotton is left white; dyed neutral, the wool is dyed very weak.

ON OTHER MATERIALS:
- **Silk:** Dyed with boiled-off liquor and sulphuric acid.
- **Leather:** Suitable.
- **Paper:** Suitable for dipping and calender work.

DISCHARGING: Discharged white with tin crystals or zinc dust.

COMPETING PRODUCTS: Made in the United States by Butterworth-Judson Corporation; Calco Chemical Company; Central Dyestuff & Chemical Company; E. I. du Pont de Nemours & Co.; National Aniline & Chemical ompany; Sherwin-Williams Company.

CHROMOTROPE 2R
(Schultz No. 40)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Dyed acid, gives a fuchsine red; top-chromed, a dull navy blue to violet black.

SHADE BY GASLIGHT: Little change.

SOLUBILITY: Good.

LEVEL: Good in medium and dark shades.

FASTNESS TO:
Acid: Fast.
Carbonizing: Fast.
Fulling: Poor; changes shade and bleeds badly.
Ironing: Fast.
Light: Stands fourteen days without change.
Potting: Not fast.
Rubbing: Fast.
Scouring: Bleeds off somewhat.
Steaming: Fast.
Sulphur: Fast.
Washing: Not fast; bleeds off.
Water: Not fast.

DYED BY OTHER METHODS: Used mainly for compound shades on woolen yarn and pieces. When dyeing silk-white piece dyes with this color or any of the Chromotropes, if they are to be speck-dyed after dyeing it is necessary to sour in sulphuric acid after speck-dyeing to prevent bleeding during sponging.

ON UNIONS: Cotton-effect threads are not stained; silk-effect threads are slightly stained, though left fairly white by the silk-white process.

COMPETING PRODUCTS: Made in the United States by National Aniline & Chemical Company; Newport Chemical Works; United States Color & Chemical Company.

AMIDO NAPHTHOL RED G

(Schultz No. 42)

COMPOSITION: Mono azo.

SPECIALLY SUITABLE FOR: Wool, as level dyeing acid color.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Similar to Eosine blue shade (S-590).

SOLUBILITY: Good.

LEVEL: Excellent if given a long boiling.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast.
Alkali: Ammonia makes the shade yellower, though the G is faster than the 2B or 6B.
Carbonizing: Fast.
Fulling: Poor; same as the Azo Fuchsines. Bleeds badly into white.
Ironing: Fast.
Light: Stands fourteen days without severe change; sufficient for ladies' dress goods.
Rubbing: Fast.
Sulphur: Fast.
Washing: Not fast.
Water: Not fast.

SENSITIVE TO METALS, LIME: The color is fast to chrome, but very sensitive to copper.

MACHINE DYEING: The color is level dyeing, but needs a long boiling to make it so.

ON UNIONS: Wool-silk—in a strong acetic bath the silk is left white.

ON OTHER MATERIALS: Silk is dyed a deep shade in a sulphuric acid bath; cotton-effect threads are not affected.

PRINTING: The colors may be printed acid on wool pieces and give a white discharge with tin. The color prints level and is fast to light, washing, sulphur and carbonizing, and stands after-treatment with chrome.

COMPETING PRODUCTS: Made in the United States by Amalgamated Dyestuff & Chemical Works (Selling Agents, John Campbell & Co.); Central Dyestuff Company; Chemical Company of America; E. I. du Pont de Nemours & Co.; United States Color & Chemical Company; Grasselli Chemical Company; National Aniline & Chemical Company; Passaic Color Corporation.

FAST ACID FUCHSINE B

(Schultz No. 41)

COMPOSITION: Mono azo type.

SPECIALLY SUITABLE FOR: Wool and silk

USUAL METHOD OF DYEING: Acid, with Glauber salt and sulphuric.

SHADE: Bluish red; considerably bluer than Chromotrope 2R.

SHADE BY GASLIGHT: Little change.

SOLUBILITY: Good.

LEVEL: Level dyeing color; suitable for piece dyeing on carbonized material.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast.
Alkali: Fast.
Carbonizing: Fast.
Light: Poor.
Rubbing: Fast.
Sulphur: Fast.

COMPETING PRODUCTS: Made in the United States by American Aniline Products; Chemical Company of America; National Aniline & Chemical Company; Newport Chemical Works; Noil Chemical & Color Works.

E. I. du Pont de Nemours & Co. announce the marketing and production of Sulfanthrene Blue GR Paste.

This is an important type of vat color that produces a shade and properties that are of very desirable interest to the cotton trade.

Sulfanthrene Blue GR Paste can be dyed on warps, piece goods, raw stock dyeing machines and all types of circulating machines.

This color, when dyed on yarns woven with white, does not bleed into the white, and if properly dyed on piece goods, does not rub off.

Technical Notes from Foreign Sources

Drying Dyed Yarns

Yarns which have been dyed or bleached on a beam may be rapidly dried without risk of breakages and delivered in a convenient form for quilling or rebeaming by contracting the yarn as it comes off the dye beams so that it passes over the drying cylinders in the form of a narrow, relatively strong belt. The dried yarn may be opened out again by an expansion comb and rewound onto a section beam. In order to utilize the full width of the drying cylinders which are generally used in the drying process, the yarn from two dye beams may be dried simultaneously, the narrow bands of yarn being guided by means of porcelain eyes fixed between the two drying cylinders in the form of a spiral from the sides to the center. An eye or guide of suitable width may be employed for contracting the sheet of yarn, or, in the case of the finer numbers, an ordinary expansion comb may be used. The apparatus for carrying out this process is described in British Patent No. 205,915.

Physical Tests on Sized Yarns

The effect of various sizing materials, such as maize, sago, farina, farina and tallow, wheat flour and tallow, and sago and tallow, upon the resistance of warp yarns to repeated variations of the tension which was applied to the latter (the tension was usually applied about two thousand times), is described in the Journal of the Textile Institute, Vol. 14, pages 375-389T. These effects were determined by means of an improved form of oscillating stress tester. The resistance of the yarn to oscillation of tension is considerably improved by the sizing that is added to it, but this improvement is almost entirely independent of the nature of the sizing materials that are used in the process. In almost all the tests that were made, apparent differences in the resistance of the yarn to the oscillating tension were traced back to inequalities in the original yarns, which were otherwise considered to be equal. The apparent equality of different sizings is explained by the assumption that the size exerts a cementing action on the yarn, and that this cementing effect is complete in nearly all instances. Sizing decreases the extensibility of the yarn by approximately 20 to 50 per cent, and it therefore appears desirable to discover a size which does not produce this adverse effect.

Dyeing Animal Fibers

In the dyeing of animal fibers by the caustic soda-sodium hyposulphite vat process it is necessary to reduce the alkalinity to avoid the harmful effect of caustic soda on the fibers. In this invention the alkalinity is partly neutralized by adding a weak acid such as benzoic acid, malic acid, phthalic acid or anhydride, phosphoric acid, or a tar acid such as cresol or phenol. Sufficient acid is added to reduce the alkali present to approximately 0.25 per cent.

In an example, a dye vat may be composed of water, 200 gallons; caustic soda, 10 pounds; sodium hydrosulphite powder, 10 pounds; Caledon Brilliant Purple RR, 10 pounds, and benzoic acid, 15.5 pounds. In the case of some vat colors, such as Caledon Yellow 3G, Caledon Red BN and Caledon Brown KT, less caustic soda is required to bring them into solution, and the quantity of benzoic acid is correspondingly reduced. Other examples are given in the patent specifications in which phthalic anhydride, phosphoric acid, ortho cresol and a mixture of phthalic anhydride and pthro cresol are employed.

For further details see British Patent No. 209,569.

Giving Cotton a Wool-Like Appearance

French Patent No. 506,126 is concerned with a process of improving the appearance of cotton fabrics so that they assume a wool-like appearance. The process consists in impregnating the cotton fabric in a solution of cellulose dissolved in nitric acid of approximately 65 per cent strength. Then the weakly nitrated cellulose is precipitated by washing the impregnated cotton fabric with water. In place of water dilute acids, ammonia or a solution of ammonium sulphate or sodium sulphate can also be employed. In printing designs on the fabric the cotton cloth is dipped into the cellulose solution and is then washed, or the fabric may be printed with a resist made of kaolin. Then the fabric is dipped in the cellulose solution and the cellulose is precipitated on the fiber.

Catalytic Activity of Tin in Reducing Dye Intermediates

Tin is a good catalyst for the reduction of nitrobenzene, ortho nitrotoluene and ortho nitroanisol by hydrogen. Of all the forms of the tin catalyst that were investigated in the research which is reported in the Journal of Physical Chemistry, Vol. 27, pages 739-760, that made from sodium stannous hydroxide, which is prepared by the action of sodium carbonate on a solution of stannous chloride, is the most efficient. Oxidation of the hydroxide prior to reduction of the metal increased the efficiency of the resulting catalyst. The lower the temperature of oxidation within the limits examined, between 150 and 300 deg. Cent., the better the resulting catalyst. The lower the temperature of reduction of the oxide within the limits of the experiment, between 350 and 237 deg. Cent., the better the resulting catalyst.

A tin catalyst in the form of coarse lumps is better than the powdered form. The behavior of the catalyst in iron and glass tubes is very different, a higher temperature being necessary in glass tubes than in iron for the same results. Tin permits of a larger variation of temperature than many other catalysts. It was found that probably a temperature varying between 275 and 294 deg. Cent. is the best temperature for the production of aniline when a glass tube is used. The best rates of flow of nitrobenzene and hydrogen with the tin catalyst compare closely with those for a copper catalyst.

RECENT PATENTS

Mercerization and Finishing of Textile Fabrics

(1,482,076; January 29, 1924)

Emile Auguste Fourneaux, Manchester, England.

A permanently lustrous, soft and elastic cotton fabric produced from ordinary cotton fabric by alternate treatment with caustic soda and thiocyanates.

Dye Solution and Process for Making and Utilizing Same

(1,485,790; March 4, 1924)

Karl Luttin, Basel, Switzerland, assignor to J. R. Geigy, A. G., Basel, Switzerland, a corporation of Switzerland.

As a new article of manufacture, a new dye solution containing at least one chloracetic acid.

The herein described process for producing dyeings and printings on textile fabrics, paper, straw, leather, wood, feathers, furs, artificial substances, etc., consisting in applying on the said merchandise, at ordinary temperature, a dye solution containing at least one chloracetic acid.

Dyestuffs Capable of Being Chromed, and Process of Making Same

(1,485,814; March 4, 1924)

Emil Reber, Basel, Switzerland, assignor to Society of Chemical Industry in Basle, Basel, Switzerland.

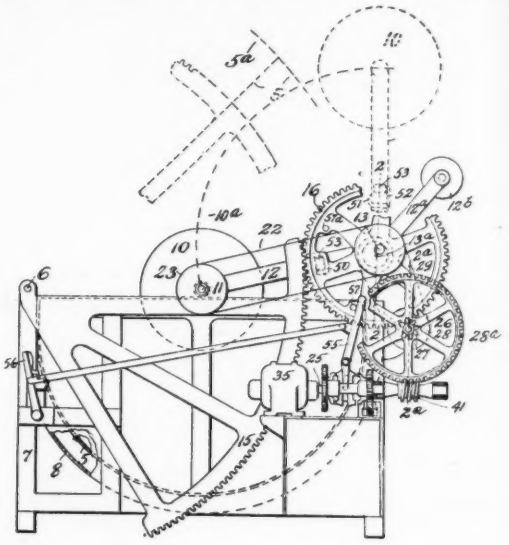
The herein described new dyestuffs resulting from coupling, in the presence of calcium hydroxide, of 1-amino-5-oxynaphthalene-7-sulphonic acid with the diazo-compounds derived from 2-amino-1-phenol containing one nitro group in another position than in 3 and 5, corresponding with the general formula R—N=N—R', wherein R signifies a 2-amino-1-phenol radical containing one nitro group in another position than in 3 and 5, and R' a 1-amino-5-oxynaphthalene-7-sulphonic acid radical, which constitute blackish powders dissolving in water with violet blue to blue colorations, and in sulphuric acid with violet red to bluish red colorations and dye wool violet brown to dark blue tints which become more or less greenish to bluish deep black when subsequently chromed.

Dyeing Machine

(1,485,884; March 4, 1924)

Robert Carl Rahm, Wyomissing, Pa.

The combination with a liquid tank, a pivoted fabric receptacle mounted to swing into or out of said tank,



and a rotary agitator pivotally mounted to swing into and out of said receptacle; of a common drive shaft and intermediate operating means adapted to either rotate said agitator independently, or to swing both said agitator and receptacle.

Process of Dyeing Cloth with Fast Colors

(1,486,353; March 11, 1924)

George J. Mess and Gordon B. Mess, Indianapolis, Ind.

The process of dyeing cloth with fast colors including applying the colors to the cloth, passing the cloth with the colors in it through a heated solution of caustic soda, afterwards submerging the cloth in cold caustic soda, then washing the cloth in cold running water, and finally subjecting the cloth to a bath of cold water containing sulphuric acid.

Process of Dyeing Raw Silk

(1,486,292; March 11, 1924)

Eugene L. Maupai, New York, N. Y.

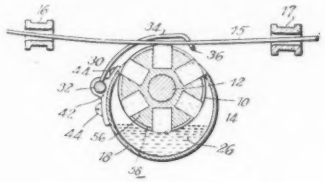
The process of treating raw untwisted silk, which consists in first dyeing it, then diazotizing it to harden the gum in the silk and fix the color, and then subjecting it to a developing solution.

Yarn-Dyeing Device

(1,488,299; March 25, 1924)

George T. Thomayer, Albany, N. Y., assignor to Fuld and Hatch Knitting Company, a corporation of New York.

A device of the type described which comprises a dry tank, a shaft extending through said tank, dye applying



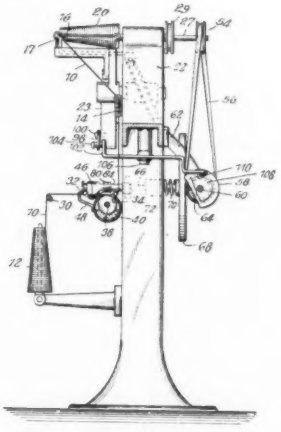
wheels on said shaft, a toothed wheel on said shaft, a rock shaft mounted on the outer surface of said tank, yarn guiding fingers extending from said rock shaft over said dye applying wheels and a ratchet arm on said rock shaft bearing against and vibrated by the teeth of said toothed wheel.

Yarn-Dyeing Machine

(1,488,298; March 25, 1924)

George T. Thomayer, Albany, N. Y., assignor to Fuld and Hatch Knitting Company, a corporation of New York.

A method of random dyeing and winding yarn which comprises, winding said yarn in successive layers of pro-



gressively increasing diameters, applying a dye to said yarn at intermittent time intervals prior to winding, and decreasing the time of said intervals in proportion to the increase in the diameters of said layers.

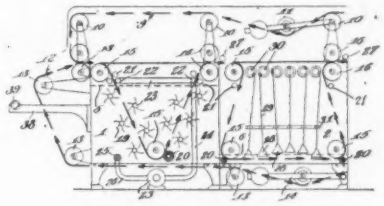
Apparatus of the type described which comprises, means for winding yarn in successive layers of increasing diameters, means for bringing yarn passing to said layers into and out of contact with a dye at successive intervals and means for decreasing the time of said intervals with the formation of each successive layer of yarn.

Washing Process and Machine

(1,487,914; March 25, 1924)

Joseph Leigh Booth, Virginia, Minn.

A process of cleaning fabrics which consists in passing the fabric over endless conveyors through a plurality



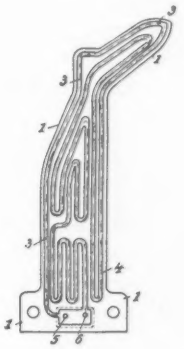
of tanks containing cleansing fluid, removing the excess fluid in the passage from one tank to the next and subjecting the fabric to a current of air in its passage from one tank to the next.

Method of and Device for Finishing Textile Articles

(1,488,293; March 25, 1924)

Fritz Schuster, Chemnitz, Germany.

The method of making heating units for glove and stocking formers and molds, comprising grooving a sheet



metal plate coating the groove with an insulating substance, heating said plate to bake said coating, loosely placing a thin resistance wire in said coated groove and covering said wire with insulating substance.

E. I. du Pont de Nemours & Co. announce placing on the market as a new product Du Pont Methyl Violet Base, which is offered as being of particular interest to the manufacturers of typewriter ribbons and carbon papers, rubber stamp inks, special marking inks and two-tone printing inks.

A serious explosion occurred March 12 at the Oppau, Germany, works of the Badische Anilin und Soda Fabrik. The extent of the damage is not known, but it is considerable, and it is thought that, as a result, parts of the works will have to close down for three months.

EMULSIONS IN THE TEXTILE INDUSTRY

(*Continued from page* 212)

genuine dispersion of the solvent with water can be diluted with any quantity of water. When this is done the distance separating the individual globules of solvent is increased by an increase in the thickness of the layer of water that lies between them.

Preparation of Emulsions

The preparation of stable emulsions is a difficult operation, as the organic solvent rises or sinks in the water in accordance with the variation in the specific weight of the solvent in relation to the specific weight of water. By the addition of certain suitable substances, which are known as protective emulsifying agents, however, the emulsified particles are prepared in such a manner that they float in the watery medium without settling out. When such an emulsion is permitted to stand for a long period of time, a layer is formed on the top of it, as in the case of milk in which the cream rises to the top and forms a distinct layer separate from the rest of the fluid. However, such a separation does not destroy the emulsion, for the supernatant layer can always be brought back into the emulsified condition again by merely shaking up the mass. The fineness of the emulsion, and as we will see later, the quality of the same are dependent to a large degree on the nature of the substance that is added, or, in simple terms, on the emulsifying agent.

Nature of Protective Emulsifiers

The best known of the emulsifiers belong to the carbohydrate group, the albumen group and principally the soap group of chemical substances. All sorts of soaps are employed more than any other class of substance in the preparation of emulsions that are used in the textile industry. The action of the soap is in this case quite similar to what takes place in the washing process, which, as is known, is based on an emulsification of the constituents of the dirt by the solution of soap. In place of the ordinary potash, soda, and ammonia soaps, certain special soaps may also be used, such as sulphonated castor oil, soap substitutes made from naphthene carboxylic acids, etc. It is also possible to prepare fat solutions in such a manner that under certain special conditions soaps will dissolve to a clear solution in the solvents, and these solutions can then be diluted with water and converted into the state of an emulsion by the user according to the standard method used in practice.

It is not the purpose of the author to go into this matter any further along these lines. In the following part of this article there is given a description of the characteristics of certain stable emulsions which have been used in the textile field for quite some time. These emulsions are made with tetralin, the new solvent which has attracted so much attention in all fields where solvents are employed, and in which the American textile industry, as well as the paint and varnish industries, have been much interested.

In preparing these emulsions eighty parts by volume of tetralin are stirred into twenty parts by volume of a 5 per cent solution of a protective colloid. The tetralin is added to the protective colloid in small amounts until the entire mass has been introduced. The agitator consists of a two-blade stirrer which is driven by a small electric motor. The agitator is made of glass and is rotated at 1,000 r.p.m. In this case the protective colloid is sodium oleate in the place of gelatine. It is obvious that the emulsions must be prepared under exactly similar conditions as far as time taken in the mixing, duration of the stirring, temperature, etc.

Because of the fact that the agitator must be rotated at such a high speed, this process cannot be used in practical work. Hence emulsions are made on a large scale with the aid of different kinds of soap as the protective colloids. In fact, these are the only protective colloids used under these conditions, and as a general rule the soap is produced right in the emulsion itself by reaction between fatty acid and alkali. Emulsions that are made with gelatine and other protective colloids whose action is not very strong, are practically of no importance from this standpoint, as these emulsions are not stable enough to be used in practical mill operations.

The Size of the Particles

The emulsions that are made with the aid of either soaps or gelatine differ from one another mainly in the size of the particles. This difference is almost likely brought about by the formation of a top layer when the emulsion is diluted with water. While the preparations that are made with soap show no separation of a top layer even after the emulsion has remained undisturbed for a period of several days, on the other hand the emulsions made with the aid of gelatine show a very distinct and rather thick top layer even after a few hours' standing. This top layer consists of a little water and mostly of large coarse particles of tetralin closely packed together. The tetralin in the rest of the emulsion is in the form of much finer particles. Such a separation takes place characteristically in the case of emulsions which are mixed with such protective colloids as albumens or casein, a typical example of which is ordinary milk in which the fat particles are present in the emulsified state.

However, in the case of fat solvents, it is necessary to prevent this from taking place as far as possible, as the principal part of the fat solvent is located in the cream or top layer, and thus goes to waste when the emulsion is used. By analyzing the different layers in the emulsions and making a microscopic examination of them to determine the size of the particles it is easy to establish the average size and the average volume as well as the average surface area of these particles.

The results of the investigation are given in the following tabulation. In this case the emulsions were made

in a proportion of one to nine of water. The determinations were carried out when a period of two hours had elapsed after dilution was effected. The number of particles in each emulsion was counted under the microscope and the diameter of the emulsion was determined by the aid of an ocular micrometer.

The tabulation giving these results follows:

WITH GELATINE

Total content of tetraline in the emulsion.		
Top layer	88.5 per cent	
Emulsion proper	11.4 per cent	
Average diameter of the particles:		
Top layer	4.21	10^{-3} mm.
Emulsion proper	2.13	10^{-3} mm.
Average size of the particles:		
Top layer	36.80	10^{-9} c.mm.
Emulsion proper	5.10	10^{-9} c.mm.
Average surface area of particles.		
Top layer	3.53	10^{-6} sq. mm.
Emulsion proper	14.25	10^{-6} sq. mm.

WITH SODIUM OLEATE

Total content of tetraline in the emulsion.	
Top layer	.....
Emulsion proper	100 per cent
Average diameter of the particles.	
Top layer	.....
Emulsion proper	1.00×10^{-3} mm.
Average size of the particles.	
Top layer	.....
Emulsion proper	0.25×10^{-9} c. mm.
Average surface area of particles:	
Top layer	.....
Emulsion proper	3.14×10^{-6} sq. mm.

Characteristics of Soap Emulsions

While the emulsions that are made with the aid of different kinds of soap do not separate and form a top layer, and while they possess particles of very small dimensions no more than one-one-thousandth of a millimeter in average diameter, on the other hand the emulsions which are prepared with the aid of gelatine have almost nine-tenths of the fat solvent present in the top layer, for the reason that the size of the particles in the emulsion is almost four times as great as that in the soap emulsions.

The mathematical results that can be derived from these facts are very interesting. From the percentage of tetralin that is found in the top layer that separates in the case of the gelatine emulsion it is quite easy to determine the number of the particles in the emulsion. In this calculation use is also made of the corresponding volume of the individual particles themselves. In the case of the soap emulsion, the entire body of the emulsion must be considered as one, and the total quantity of tetralin used in the making of the same must be taken into consideration. Furthermore, in a similar manner it is possible to establish the average diameter of all the particles in the emulsion, and finally it is also possible to determine what is known as the internal surface area of the same.

The latter factor is the product of the number of particles in the emulsion and the surface area of an individual particle. The average surface area of the individual particles is employed and this is, of course, very small. However, as the number of particles increases enormously as the size of them becomes less, the internal surface area of the emulsion must increase as the degree of dispersion increases.

A tabulation of results is given below:

Number of particles.	With Gelatine	With Sodium Oleate
Top layer	$1{,}923.8 \times 10^{9}$	.....
Emulsion proper	$1{,}784.3 \times 10^{8}$	$152{,}800 \times 10^{9}$
Total number of particles in the entire emulsion	$3{,}708 \times 10^{9}$	$152{,}800 \times 10^{9}$
Average diameter of all the particles in the emulsion	3.45×10^{-3} mm.	1×10^{-3} mm.
Internal surface area:		
Top layer	103.0 sq. meter	.....
Emulsion proper	25.4 sq. meter	480 sq. meter
Total internal surface area of the particles in the emulsion	128.4 sq. meter	480 sq. meter

Importance of the Internal Surface Area

The magnitude of the total internal surface area of the particles in the emulsion is of the highest importance in determining its quality of the same, as all processes that involve the dissolving of substances and the removal of foreign matter and dirt from textile materials are enhanced by adsorption, when the particles of the substances which are to be dissolved out of the fiber come in contact with a dissolving surface which is as large as possible. As has been shown, the magnitude of the internal surface area of the emulsion and the smallness of the individual particles and hence the number of the particles of fat solvent present in the emulsion are very closely interrelated. The smaller the particles of the fat solvent the easier it is for them to penetrate the narrowest places or force their way through the finest capillary openings.

As the size of the individual particles decreases, the number of them increases, while the total quantity of the fat solvent in the emulsion remains constant. In other words, there is present a greater chance for the particles of the fat solvent to come in contact with the impurities and the dirt which must be dissolved out of the fiber.

The most important point and consideration in an active emulsion is consequently the fineness of the particles, whose necessary adjuncts are a large number of particles and a large internal surface area in the emulsion.

(To be concluded)

Over 20,000 workmen were dismissed recently from the Badische Anilin and Soda factories at Ludwigshafen and Oppau, Germany, in consequence of their refusal to work nine hours daily. Conflicts between the locked-out men and the police occurred outside the Ludwigshafen factories, according to a Reuter's dispatch.

REPORTED NEW TARIFF RULING

Although Customs Bureau officials at Washington have received no confirmation of it, a report has been published that a new ruling makes dutiable under the present tariff act the royalty paid by dye importers to the Chemical Foundation, Inc., and the Grasselli Chemical Company on those imported German dyes and chemicals which are covered by the enemy-owned patents seized during the war and transferred to the Chemical Foundation by the Alien Property Custodian and on the Farbenfabriken vorm. Friedr. Bayer & Co. patents sold to the Grasselli Chemical Company.

Both companies charge a royalty of 10 per cent of the American selling price on all imported colors covered by the patents, which the importer collects from the consumer and turns over to each concern at stipulated periods. Heretofore the royalty has been charged by importers as a separate item, not as part of the regular selling price, and has up to now been so regarded by customs appraisers, and therefore not subject to duty under the tariff. The new tariff has been operating for a year and six months, but not until now have the customs officials deemed it proper to pass this new ruling. The reason for its delay is unknown.

It is reported that the ruling will be contested, inasmuch as many importers believe it to be an unfair scheme which will unreasonably increase the retail price of imported dyes and consequently act against the consumer who must pay the added duty.

DYE CENSUS WORK PROGRESSING

The prompt response to the questionnaire sent out by the Tariff Commission has enabled the compilers to accomplish considerable work on the 1923 census of dyes and other synthetic organic chemicals. It is not improbable that a preliminary statement of production figures will be ready for distribution some time in April. The data compiled to date indicate a surprising increase in dye production for last year in contrast to the decline of 1921. Apparently the momentum gained in 1922 extended throughout the greater part of 1923 to meet the steady flow of domestic and foreign demands for colors. It is even possible, reports say, that last year's production may equal or surpass the great record for 1920.

The Lowell Textile School Alumni Association will celebrate its twenty-fifth annual meeting on May 24. The officers and executive committee are working in an effort to make this meeting a memorable one for the members. They are planning a reunion of the earlier graduating classes and desire to get in touch with members of classes from 1900 to 1905, inclusive. Notice and details of the meeting will be sent to all members about April 15.

DYESTUFFS CORPORATION OF AMERICA

Under date of April 1, 1924, a notice has been sent to the trade advising of the establishment of "Dyestuffs Corporation of America" as the trading successor to the businesses formerly carried on by I. Levinstein, Inc., and Read Holliday & Sons, Ltd. The notice is signed by Edgar Levinstein, president; H. R. Davies, treasurer, and M. S. Chandler, secretary, on behalf of the new corporation. All of these individuals have heretofore been officers of I. Levinstein & Co., Inc.

It is understood that the Dyestuffs Corporation of America will, for the present at least, make its headquarters at 281 Franklin Street, Boston, the former offices of I. Levinstein & Co., Inc., and that it will act as American representative of British Dyestuffs Corporation, with which organization it is closely affiliated.

The Lancaster Mills, Clinton, Mass., are setting up in their picker house eighteen cards which have not been in use for about two years. They are also installing a new printing machine in the print room of the dyehouse and are making other improvements about the mills.

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Thirty years' varied experience in the dyestuff business, associated with the most representative importing and domestic houses, holding positions of wide responsibility. Thorough acquaintance with all types of dyestuffs, and requirements of prominent consumers. Unqualified credentials. Presently available. All communications confidential. Address Box 242, American Dyestuff Reporter.

WANTED.—Chemist who is perfectly familiar with manufacture of DIAZINE BLACKS and all the necessary intermediates in its manufacture. Write Box 250, giving all details.

MAN OF WIDE EXPERIENCE IN TEXTILES—laboratory, plant and research—desires to install and operate laboratory to control dyes, chemicals and processes, and develop new ideas. Must satisfy himself of possibilities for saving money and improving processes or product before accepting position. Address Box, 251, American Dyestuff Reporter.

COLOR MATCHER

Color matcher wanted for New York laboratory of large dyestuff manufacturers. A young man who has had previous experience is desired. Address Box 252, American Dyestuff Reporter.

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An Epoch in the History of Liquid Chlorine

THE recent decision of the Interstate Commerce Commission, giving tank car rates and privileges to the Mathieson Multi-Unit Chlorine Gas Tank Car, marks an epoch in the history of Liquid Chlorine.

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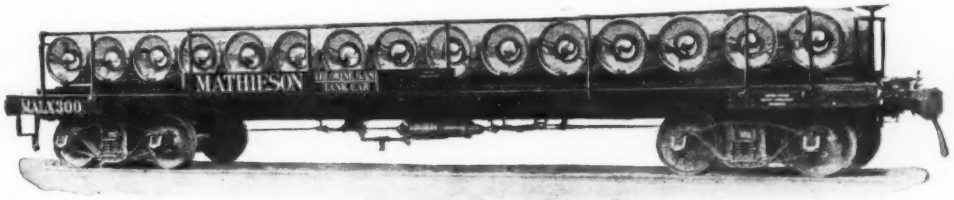
During the past two years we have paid out over two hundred thousand dollars in excess freight charges in order that the chlorine-consuming industries might benefit by the continued service of a tank car ideally constructed for the safe, economical and convenient use of Liquid Chlorine.

The present decision of the Commission upholds our faith in the Multi-Unit "Safety First" principle and awards us full reparations with interest.

Thoughtful consumers will recognize in this case a further proof of the leadership we have assumed in the chlorine industry.

You are cordially invited to visit us in our Booth, No. 252, at the Knitting Arts Exhibition, Philadelphia, Pa., April 7th-11th, 1924.



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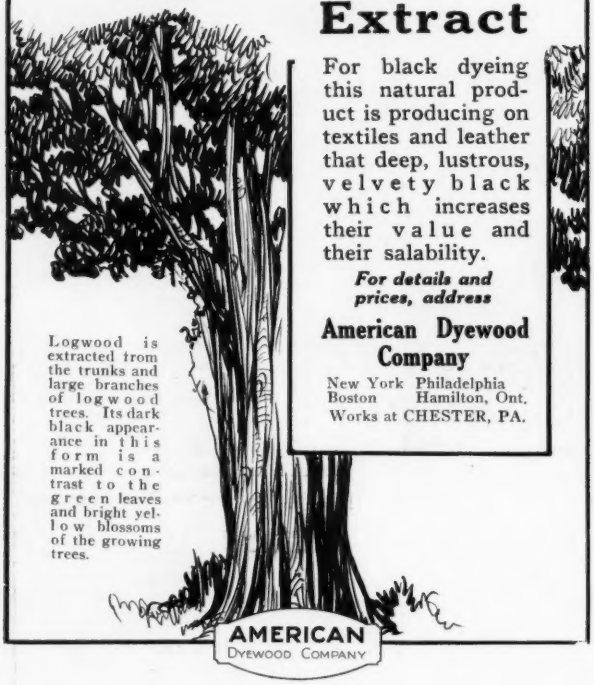

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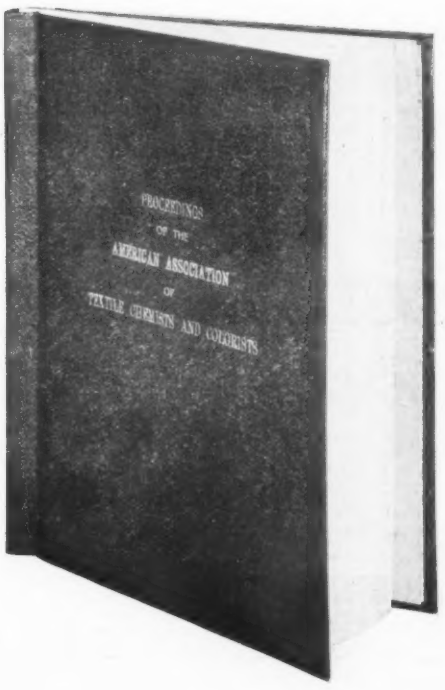

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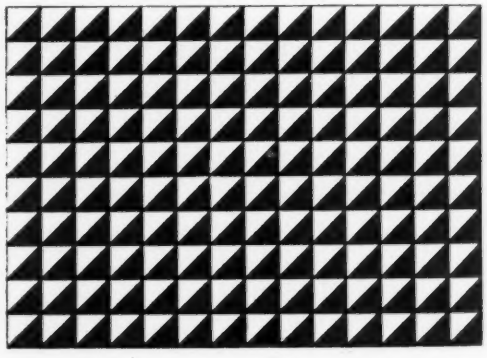

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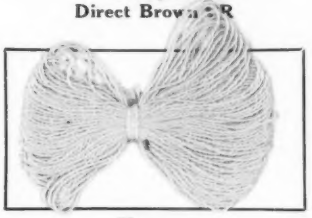

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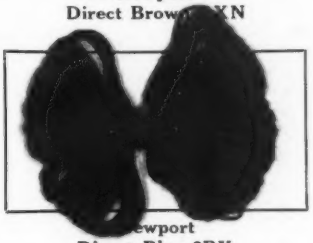

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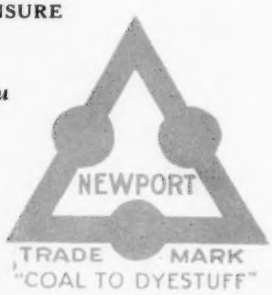

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Passaic, New Jersey

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